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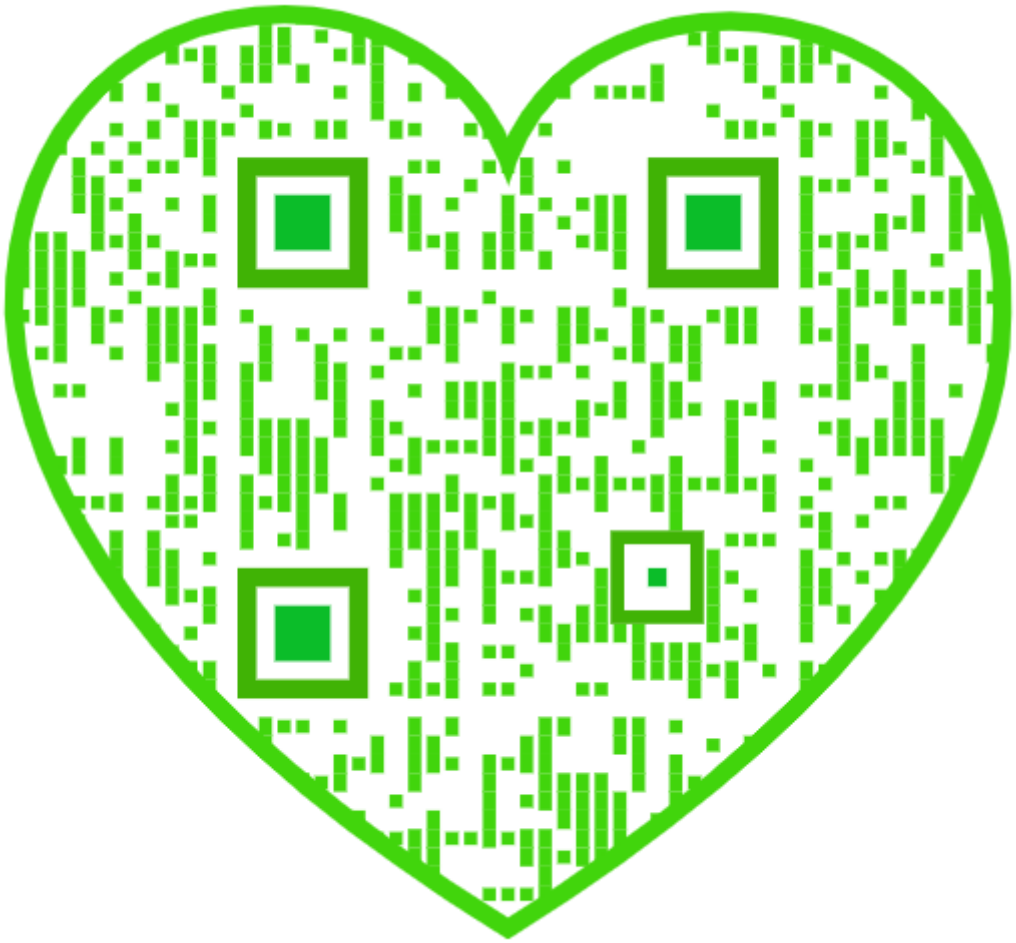
Figs. 1, 2, 3, 4.—Designs in Wood Carving for Frame of Butter-Dish.

Fig. 6.—Design for Centre of Panel, etc. Figs. 7, 8.—Designs for Corners of Panels.

DESIGNS FOR FRAME OF BUTTER-DISH AND OTHER ORNAMENTAL WORK IN WOOD CARVING.



A BUTTER-DISH, AND OTHER DESIGNS FOR WOOD CARVING.

BY W. H. GRIMWOOD, INSTRUCTOR TO THE SCHOOL OF WOOD CARVING, SOUTH KENSINGTON.

DESIGNS FOR BUTTER-DISH, MEDALLION, AND SPANDRELS, WITH INSTRUCTIONS.

THERE are few arts that are more fascinating in themselves, more useful for decorative purposes, or better suited to the requirements, power, and resources of amateur wood workers of either sex than wood carving; and it is *par excellence* an art that women can take up, and in which they may attain considerable proficiency. I think I may assume without fear of contradiction that every amateur who takes up any manual art likes to have the work of his or her hands, as the case may be, on view as frequently and prominently as possible, and that to this end, designs that are applicable to the elaboration of household furniture, or the ornamentation of articles used on and for the table, are perhaps more acceptable than any other. With this view I have supplied, at the Editor's request, four designs for butter-dish frames, or wooden discs or platters, hollowed out in the centre to a sufficient extent to receive and hold a shallow glass dish for butter, to be obtained at most shops in which glass and earthenware are sold.

Of these designs, two are arranged on conventional lines, or, in other words, exhibit a natural object—in this case the buttercup and its foliage—conventionally treated; a third, a seventeenth century design, and the fourth a design in Italian style. In treating the butter-dish, the designs for which it must be understood are confined to the circle in which are placed Figs. 1, 2, 3, and 4, the design selected having to be carried in continuance of the portion given, right round the sloping edge of the dish, care must be taken, first, to turn, or get turned, a disc suitable for the purpose in view, in accordance with the section given in Fig. 5; and having obtained this, to ground to section given for carving very slightly at the sides and deepest in the centre, or the effect will not be so good. Lime or sycamore may be the material used for the dish, or, better still, holly or Italian walnut. Unlike bread platters, the frames do not require washing, which spoils the colour of the wood. The glass, being loose, can be removed whenever it is necessary to wash it, and a brushing with beeswax only is all that is required to keep the frame in order.

As the Editor has a deeply rooted objection to anything in the form of waste, whether of space in a page of the Magazine or otherwise, and strictly charged me to avoid any indiscretion of the kind, I have given in the space occupied by the glass in the butter frame a design which has no connection whatever with the butter-dish itself, and which is intended as a medallion for the centre of a box-lid, drawer front, panel, etc. This subject, which is shown in Fig. 6, should be grounded out to the depth of $\frac{1}{4}$ in., or carved in high relief. Amateurs must ever bear in mind that the higher the relief the greater will be their difficulty, unless they understand modelling. I may remark that all grounds may be stamped, punches in different patterns being supplied for this purpose.

The designs given in Figs. 7 and 8 are suitable for corners of panels, or may be utilised—as indeed may all the designs—for *repoussé* work. The whole as placed in the page can be used for a square panel, one design, as a matter of course, being used for the four corners, and one of the four designs given for the ring encircling the central medallion. Moreover, spandrels should be selected to suit the conventional or natural design selected for the ring surrounding the centre.

Further, the wood carver must understand that the same designs will apply, with necessary modifications, for borders, frieze, uprights, and mouldings, flat or on the round. If flat, the ground should be of the same depth all through. Lastly, they may be enlarged to suit the requirements of wood carvers to any size, due care being taken to preserve the proportion between the different parts of the designs. A little tasty knowledge of drawing and skill in adaptation is all that is necessary to secure their successful application to the purpose in view.

ELECTRO-GILDING BROOCHES, CHAINS, RINGS, ETC.

BY GEORGE EDWINSON BONNEY.

IMPERFECT ELECTRO-GILDING—HOW TO CLEAN THE TRINKETS BEFORE GILDING THEM—DOCTORING SOLDERED JOINTS—HOW TO MAKE AN ALKALINE COPPERING SOLUTION—USE OF THE COPPERING SOLUTION—SCRATCH-BRUSHING AND FINISHING ELECTRO-GILT ARTICLES—POLISHING ELECTRO-GILT TRINKETS.

Imperfect Electro-Gilding.—We may take a brass ring from a man's finger, and, seeing that it is bright and clean, conclude it will not need cleaning before hanging it in the gilding bath. We therefore merely wipe the ring with a scrap of rag, tie a bit of copper wire to it, and hang it in the gilding bath. In a few moments it has received a coat of gold all over, and bears the appearance of a golden ring. We then rinse it in warm water to free it from the cyanide salts, wipe it dry with a rag, and hand it back to the wearer, gilded. This looks very well at first sight, and vast numbers of brass rings thus gilt are sold by cheap Jacks to gullible youths and maidens. Rub the ring a little with the palm of the hand. The very thin coat of gold can be thus rubbed off in a few moments, leaving the bare brass plainly visible. All trinkets may be thinly gilt in a similar manner, and the thin coat of gold can be as easily rubbed off. If the ring or any other similar article is left in the gold bath for a few minutes, it will take on a brown coat instead of one having a golden tint. This brown coat is merely the matt appearance assumed by electro-deposited gold, and this will entirely disappear on brushing the coat with a brush of fine brass wire kept lubricated with stale beer. But on brushing in this way an imperfectly cleaned ring as it comes from a person's finger, we may notice that the ring assumes a brassy appearance, because the gold went on loosely over the sweaty parts of the ring, and these loose particles of gold were readily detached from the imperfectly cleaned spots by the wire brush, because they did not adhere to the brass, but only to the film of dirt on the brass. This non-adherence of electro-deposited coats becomes more apparent with thick coats than with thin ones. To get a perfectly adherent coat of electro-deposited metal, we must thoroughly clean the surface on which we intend depositing the coat. Let the ring, or brooch, or pin, or coin appear to be ever so clean to the eye, it must have contracted a trace of animal grease, or sweat, if it has been handled or worn, and this film of animal matter must be taken off before we can deposit a coat of adherent metal on the article.

Cleaning the Trinkets.—All animal matter, such as grease, oil, and sweat, may be loosened from the surface of metal by boiling it in a solution of strong alkali, such as soda, potash, or ammonia. A strong solution of washing soda may be used if nothing better can be obtained. Pearlash is a better cleanser; American pearlash, or potash, is still stronger; and the best cleansers (in general use by professional platers) are commercial caustic soda and caustic potash. A piece of either of these, about the size of a walnut, dissolved in half a pint of hot water, will be enough to clean a dozen or two of small trinkets or chains. First dissolve the potash or soda in hot water, then string a few trinkets on about 6 in. of No. 20 or No. 22 copper wire, and swill the bunch for a few minutes in the hot liquor. Transfer from the hot caustic solution to some clean warm water, and well rinse the trinkets in this, to clear off the loosened grease. When the caustic liquid is cool, put it in a closely stoppered bottle to exclude the air, and thus preserve it for future use. After the grease has been loosened, if there is no corrosion on the article, it must be briskly brushed with a little whiting, or prepared chalk, or finely powdered pumice, again rinsed, then hung in the gilding solution to receive its coat of gold. If the trinkets are corroded, the corrosion must be removed in a pickle made of two parts sulphuric acid, two parts water, and one part nitric acid, after which the articles must be rinsed in clean water. Chains of a strong pattern may be rolled up in a mass between the two hands with a little whiting, and rubbed until polished; but those of more delicate construction may not be treated in this way, but must be carefully brushed. Filigree work will require very careful treatment in cleaning, and the gold should be deposited on it with low battery power, to prevent browning the deposit, since it cannot be well brushed bright afterwards. Long chains of a delicate pattern should be threaded on a long thin copper wire passed through the links at intervals of from 2 in. to 3 in., or the wire should be wound spirally around the chain, to assist in conducting the current to all parts equally. Ear-ring and brooch pendants made of metal beads strung on silk should be suspended in a small basket of platinum gauze, in order that the beads may be placed in connection with a conductor of electricity, since silk will not conduct the electric current. This class of goods should not be put in the caustic solution, as this will dissolve silk, and cause the beads to drop off. It is also important to note here that all trinkets containing hair, photos, and other material likely to be injured by the hot gilding solution, must not be put in the caustic solution until the hair, photo, etc., has been removed. It is also advisable to remove glass and stones liable to injury from this cause, and to re-set them when the work is finished. Trinkets made of aluminium only will not receive a coat of gold, but will dissolve in caustic solution and in the gilding solution. The brush used in brushing articles before gilding may be an old, but clean, tooth-brush, or any clean brush with stiff bristles.

Whilst finishing the articles, we shall note the condition of their surface. If this has been scratched, or dented, or bruised, or pitted with corrosion before it was taken in hand to be gilded, the marks of injury cannot be

obliterated by polishing and burnishing afterwards. All such blemishes must be removed before the articles are cleaned, if they are to be removed at all, and this can only be done by hand, either by pressing out the dents with suitable pieces of wood, or removing the scratches with a fine file and burnishing the filed spot. All repairs must be done first, as it will be difficult to repair electro-gilt goods when finished.

Doctoring Soldered Joints.—If there are any joints made with soft solder, these will be difficult to coat with gold. If they are small, they may be doctored up in the following manner:—Get a piece of blue-stone (sulphate of copper) about the size of a broad bean, wet it, and rub on the soldered joint for a minute or so, then touch the joint with a piece of bright iron or steel. Both the iron and the joint will take on a coat of copper and cover the solder. Rinse the joint in clean water, and hang the article in the gilding solution, when it will take a coat of gold.

If there are several soldered joints or much soft solder about the article to be gilded, or if it is desired to coat a pewter medal, lead cast, zinc ornament, piece of tinned iron, or article composed wholly or partly of iron, tin, lead, or zinc, it will be advisable to first coat it entirely with copper in an alkaline coppering solution, made up in the following manner:—

Alkaline Coppering Solution.—Dissolve one ounce of copper sulphate (blue-stone) in one pint of hot rain-water. Add strong liquid ammonia to this, in small quantities at a time, and stir well between each addition of ammonia until the green precipitate first formed by the ammonia has all dissolved, and the liquid assumes a beautiful blue tint. Then add cyanide of potassium dissolved in water until the blue tint disappears, and the liquid has the appearance of old ale. It should now be heated to boiling point; then set aside to cool in the open air, and not be used until the next day. At least three cells of a battery will be needed to deposit copper from this solution, and perhaps four cells, arranged in series, may be required to force the copper on a soldered joint; but the copper thus deposited will be firm and adherent, and may be polished. This is not the case with thin coats of copper deposited from acid solutions of copper. Use a piece of good copper, such as electrotype copper, as an anode in the coppering solution. If a crust of green salt forms on this whilst working, add a little liquid ammonia to the solution; but if a blue crust forms on the anode, add a little cyanide of potassium to the solution. A mere film of copper will be all that will be required on the article to protect it from the action of the gilding solution. If the film does not go on evenly in a few minutes, take the article out of the bath, and briskly brush it with a brush made of brass wire, then return it to the coppering solution. This solution may be worked cold or hot, as may be desired; but the deposit is brighter from a hot solution than from a cold one. It is not only used in coppering articles to be gilded, but also to coat iron, tin, zinc, lead, pewter, and similar metals, before they are silver-plated, since silver will not adhere to those metals. It is also useful to give an 18-carat gold appearance to gilded or pure gold goods. This is done by merely flashing a film of copper over the surface when finished, then flashing a film of gold on this, rinsing at once in hot water, and drying off in clean sawdust. By careful working in this way, a clever workman can get any desired tint of gold on the surface.

Finishing Electro-Gilt Articles. — On taking strongly gilt articles out of the electro-gilding solution, they will be found to be coated with a brown powder. This powder is finely divided gold in a crystalline condition, the mass of crystals absorbing, instead of reflecting, the light. To remove this brown appearance, the articles are briskly brushed with a brush made of fine brass wire specially drawn for the purpose, and named scratch-brush wire. Scratch-

Fig. 4.—Scratch-Knot made of Scratch-Brush Wire.

brushes are made up in various forms, to suit the kind of work to be brushed by them; but the usual form of the ordinary scratch-brush is that of a small boxwood cylinder with bunches of wire sticking out on all sides. This is mounted on the spindle of a lathe, and revolved at a high rate of speed, whilst the work to be scratch-brushed is held to the brush by the workman. The ends of the brass wires wear down the points of the gold crystals, and render the whole surface smooth. To prevent the brass from wearing off in the shape of dust and cutting the gold coat, the brush is kept lubricated with stale beer, and is covered with a hood, to prevent the lubricant from being splashed over other things in the workshop. When a plater has not a suitable lathe, the scratch-brushes are made like narrow plate-brushes or a tooth-brush with a wooden back, and are manipulated by hand. Amateur platers and gilders with small means are content to use scratch-knots made by themselves out of bunches of scratch-brush wire, as shown at Fig. 4. The wire is sold in knots: *i.e.*, small hanks, in three grades—heavy, medium, and fine—at prices ruled by the market price of brass wire. The fine wire is most suitable for gold work. Get a knot of fine scratch-brush wire and a few yards of No. 20 soft copper wire. Fasten one end of the copper wire to a nail or hook driven in a wood post, lay the hank of brass wire on the other end of the copper wire, and wind this tightly around the hank until all the middle of the hank has been covered with the close coils of copper wire, then tuck in the free end, and fasten it off. Next cut off the loops at each end with a pair of sharp shears or with a sharp chisel, whilst resting the loop on a block of wood, and thus form two brushes, one at each end. First rub the freshly-cut ends on a rough stone, to dull the points of the wire before using the brush on an electro-gilt surface. When the ends are too much burred by use, cut them off with a sharp chisel, and unwind the binding wire a few coils at a time, as needed, when the brushes wear short. With even such scratch-brushes as these, some good work can be done by hand, but it can be done more expeditiously with a revolving scratch-brush. Rest the work on a sloping piece of board over a vessel placed so as to catch the drips of stale beer, and work the brush from left to right, away from the workman, going over all the surface until all the brown appearance has been removed. Do not leave any of this in the crevices.

Lastly, rinse the work in warm water, and dry it in hot boxwood sawdust. Then polish with dry rouge on a plate brush, or burnish with highly polished steel burnisher, or one of highly polished bloodstone, using newly made soapsuds as a lubricant.

THE VIOLIN: HOW TO MAKE IT.

BY J. W. BRIGGS.

SPECIAL TOOLS — PURFLING GAUGE — KNIFE — ROUTER—IRON CRAMPS—PLANES—APPLIANCE FOR BENDING RIBS—THICKNESSING GAUGE—STEEL SCRAPERS — HAND SCREWS — SPRING DIVIDERS, ETC.—CARVER'S SCREW—FILES AND GOUGES—JOINTING—TRUEING UP—MARKING BACK AND BELLY FOR RIBS—BENDING RIB STRIPS—GLUING RIBS—PLANING DOWN RIBS—MARKING BACK AND BELLY FROM RIBS—SAWING OUT BACK AND BELLY.

Special Tools.—In addition to the ordinary tools which are found in any joiner's shop (both professional and amateur), such as smooth plane, trying plane, saws, chisels, and the like, there are some special tools which would not be found there, and of which I will give a short description; but from the illustrations my readers may gather, perhaps better than from any description I might give, the manner in which some of these things are "fixed up."

Purfling Gauge.—The purfling gauge or cutter (A, Fig. 5) is a steel shell 4½ in. long by ¾ in. broad and ⅜ in. thick, with a projecting end half an inch long and $\frac{3}{16}$ in. in diameter; carrying a brass roller, which brings the thickness to ⅜ in. Half an inch from the bottom of the shell are two thumb-screws, one in each side; these are for adjusting and fixing the steel blades or cutters which run longitudinally through the instrument. I have ground the cutters in my gauge to "spear" points, and they answer very well.

Knife.—B is a knife such as is sold by stationers for erasing, but is ground to a long keen point. Two or three of these should be at hand; they are used for deepening the groove in which to lay the purfling, for trimming the sound holes, and many minor purposes, and should be kept as sharp as the proverbial razor.

Router.—The router (C) is a small bent chisel with which the piece marked by the purfling tool is taken out.

Iron Cramps.—Two forms of iron cramps are shown in D and E; six of the smaller are required for fixing the ribs on the model. F is a cramp which is sold by the dealers for fixing the back and belly to the ribs. G is one of my own design and make, and is, I consider, a great deal better than F. It is lined with cork on both the inner sides, and cannot possibly injure the most delicate instrument. The small cramp (P) is used for fixing linings in the waists; the other linings need no cramps.

Planes.—I is a small oval iron plane, with toothed blade, slightly round both in length and width. J is a similar plane, but with flat bottom. This is the most useful little tool for a number of purposes.

Appliances for Bending Ribs.—The apparatus for bending ribs (K) is of totally different construction to the one generally used; it is a piece of ¾ in. iron pipe, cut open all the length, and is heated by gas, as the illustration shows. The tube is fixed in an iron vice, and the gas heater is suspended from it by wires passing round each end of the tube.

Thicknessing Gauge. — The thicknessing gauge, or automatic measurer, is one of the most important tools in a fiddle-maker's "kit"; the one here given (L) is my own make, but was, like the bending apparatus, invented by my esteemed tutor, Mr. Wm. Tarr, of Manchester, now in his eighty-third year, and who is, I understand, the oldest living English violin maker, three of his 206 double basses having been made in 1829.

This gauge is extremely simple in its action, gives the most accurate measurements, and is not likely to get out of order. The small point of the gauge being held lightly underneath the back or belly, the thickness of which you desire to know, the ivory rule, the point of which traverses the surface, shows it at a glance in thirty-seconds of an inch.

Steel Scrapers.—M and N are steel scrapers, having one flat edge and three different round ones. The edges should be ground square across, the scraper placed edgeways in a vice, and sharpened by drawing the polished back of a gouge, or a proper "scraper sharpener," along the edges, at an angle of about 60°. A scraper sharpener is a piece of ½ in. round polished steel, and is fixed in an ordinary tool handle. When the scrapers become dull, draw the sharpener flat along the sides; this turns the "burr" to the edge again, then sharpen them in the vice as at first.

Hand Screws.—Hand screws (O) are often wanted; two or three sizes should always be in the work-room.

Spring Dividers, etc.—At Q is shown a pair of spring dividers, which are used for measuring distances very finely. The spring callipers (R) will be very useful, especially when finishing the neck. A pair of strong steel compasses (S) must be obtained. Never use the dividers for any purpose for which the compasses are intended.

Carver's Screw.—The point of the carver's screw (T) is to be firmly screwed into a carving block, and the stem passed through a hole in the bench, underneath which the wing nut is screwed on the stem. The carving block may be turned in any position, and, by tightening the nut, instantly made fast again.

Small Square.—A small square (U) is an absolute necessity, being in frequent requisition for such purposes as squaring the rib ends, testing the truth of blocks, etc.

Fine-Toothed Plane.—A fine-toothed plane, such as cabinet makers use for veneering, is frequently required, more especially if you use sycamore, which is strong in "figure."

Files and Gouges.—Several half-round files, different sizes, and of varying degrees of fineness, will be necessary, as also the "omnipotent" *gouges*, without which we cannot possibly get along. The "sweeps," or curves, given in Fig. 5 will be sufficient for our requirements, but a fiddle maker, it may be said, cannot have too many kinds of gouges.

Oilstones.—The oilstones for sharpening the gouges, both inside and outside, will, of course, be essential, as well as a good oblong oilstone set in case for sharpening plane knives and chisels.

Shell Bits, Cutting Gauge, etc.—Some violin makers use, for cutting the circular extremities of the sound holes, steel cylindrical shell bits, with diameters of ¼ in. and $\frac{5}{16}$ in. respectively. These holes may also be bored by the same sizes of centre-bits, but great care must be taken not to use too much pressure, as the sound holes lose much of their beauty if the sharp corners be broken off. A cutting gauge, for reducing the edges of back and belly to their proper thickness, and a slightly tapered shell-bit for boring the peg holes in the handle, will also be wanted.

Jointing.—We have now all the wood, models, and tools ready, and can commence our work by jointing the back and the belly, the pieces for which should be cut through as at B, Fig. 1 (page 4, Vol. III.); the insides of each piece should be planed quite true—*always plane the back across the grain*, otherwise you will jerk pieces out of it; then placing the true side downwards on the shooting board, with the trying plane make along the thick edge a perfectly square joint. This, to an unpractised hand, will be a matter of great difficulty, and an amateur would be well advised to get this process done by a cabinet maker who is accustomed to making fine joints. There is so little wood to spare, that if you should be so unfortunate as to make a bad joint you may not have room to remedy the defect. When both pieces are planed so true that you cannot see between them when placed together and held up to the light, hold both edges before the fire till quite warm, then fasten one piece in the bench vice with the planed side towards you; place the other piece with the true edge touching it, and very quickly go over both edges with fresh glue, very hot; now put the loose piece in position, and rub it slowlybackwards and forwards, pressing firmly the while. When you have rubbed out as much glue as possible, which will be known by the amount of suction that ensues, and the pieces are quite even, sponge the joint both sides with hot water and remove the jointed piece from the vice; put it aside to set, and proceed to joint the other pieces. Whilst the back and belly are laid away to harden, take the inside model, and into each of the six recesses glue a piece of the 1 in. pine, width to suit, and rather longer than the depth of model; use only a small quantity of glue for the back of each block, as they will have to be forced out again when the ribs are finished; but for safety, cramp them into position with your iron cramps, and put the whole in a warm place to dry. After your joints are thoroughly hard (twelve hours at least should be allowed for this purpose) you must plane the flat sides of each piece quite true every way—lengthwise, crosswise, and diagonally.

Truing up.—For "truing up" the back, I use a plane of the same size as a "jack" plane, but bearing a coarse toothed iron, almost vertical; this was made to my own drawings by Varvill, of York; and if any reader wishes to have a similar one, I will supply details. For truing the belly use the trying plane.

Marking Back and Belly for Ribs.—The back and belly are now ready for marking from the ribs, and as these are not made, we must get them together.

Take the inside model into which the six blocks have been glued, and plane these down to the level of the model, but take care not to injure the latter in doing so. With a straight-edge continue the centre lines on the model, across each of the end blocks. Place the inside pattern to the centre line, and even with the model all round, next carefully trace the outline on the blocks; now turn the pattern and mark the other blocks in the same way. This done, write on each block, inside the marks, figures corresponding with those on the model, and repeat the whole process on the other side. With gouge No. 4 cut out the hollows in the insides of waist blocks; if you find that the wood is cutting inwards, turn the model over, and cut from the other side. Do not cut within the marks, and carve only the *insides* of waist blocks at present. *Make twenty small cuts rather than one too deep.* You should now fix the model edgeways in a wood vice, as you did when trimming it up after being sawed out, and, with the round side of a file to fit the sweep, take out all the inequalities which may have been made in carving, and make the hollows square across. The filing gives a better gluing surface for attaching the ribs.

Bending Rib Strips.—The next operation is to prepare the rib strips for bending. With one of the iron cramps fasten one of the strips by its extreme end to the bench, and place a small piece of wood or cork under the cramp, so that it will not damage the rib; and with the veneer plane work from the cramp to the end of rib, and take off the rough part of the wood. Now loose the cramp, turn the rib end for end, and plane the part which the cramp prevented you getting to previously. When all the strips have been treated in the same way, fix them on the bench again, and with a flat scraper, which must be very sharp, take out all the plane marks. Use the scraper diagonally, to cross the figure of the wood.

Divide the strips with a sharp knife, and the square into lengths of $5\frac{1}{2}$, $7\frac{1}{2}$, and $9\frac{1}{2}$ in. One strip will make two top or $7\frac{1}{2}$ in. ribs; the other two will each make one bottom and one waist rib. The next process is one which demands both steadiness, care, and patience, as accidents are very likely to happen, and another rib may have to be planed up. Fix the bending apparatus (K, Fig. 5) in an iron vice, attach an india-rubber tube from the gas to the heater, and light the gas, but observe that it does not light at the wrong place. Turn the gas very low, and when the tube is sufficiently hot to scorch very slightly a piece of paper held on it, the ribs may be bent as shown in Fig. 6.

Begin with the waist ribs, and make sure that the figure of all the ribs matches in inclination; it is better to mark each rib to the blocks before bending any of them. Do not hurry the bending; use only gentle pressure; when hot enough, the ribs may be bent any way you wish. It is safer to have near you a small bucket with cold water and a sponge in it; and if the tube gets too hot you can then cool it a little. Frequently try the waist ribs in course of bending into the places already prepared for their reception. The others you may bend to fit the inside pattern.

Gluing Ribs.—Now make a "caul" or small block of wood (the 1 in. pine will do very well) to fit each of the hollows, and mark them to their places; then put them on a stove or near the fire to get hot; this causes the glue to set much sooner. Lay a coat of glue on one waist block, place the hot "caul" against it, and putting the end of an iron cramp into the hole exactly facing the hollow, cramp it close up, but see that both edges are a little "proud" of the model. You will not be able to glue both ends of each rib at one operation; let one end set before gluing the other, as the cramps might be in the way of each other.

When all the ends of waist ribs are fast, in proper positions, you should with a flat toothing plane cut the ribs down level with the model.

Now carve the remaining blocks in the same way as you did the waists, but you must cut through the end of each *waist rib* as well as the block to which it is attached, otherwise a nasty joint may result. Correctly file all the six blocks and make "cauls" to fit each, then mark them to their places. Glue and fix each of the corners, leaving top and bottom until the last. There is no necessity to make a joint with the ribs at the top, as both ends will be cut away when you fix the neck. If the bottom joint of ribs is not good, the defect

may be remedied by inserting a piece of purfling or fancy wood, but this must be exactly true to the centre mark. I have a weakness for putting in a narrow strip of ebony, and think it looks very well when finished: the bottom nut or rest crossing the top of this piece makes a "capital" T.

Planing down Ribs.—When the ribs are firmly set you should proceed to plane them down to the model, and finish them in the following way: set your compasses to $3\frac{3}{4}$ in., and from the point where the short line crosses the centre line of model, describe a circle, whose circumference gives the points at which the ribs should be square across. Fasten the model edgewise in the vice, and file each curve square across and free from inequalities, and make the entire set of ribs an equal thickness. After this has been nicely done, scrape them over, and give three or four courses of sand-paper, the last one very fine, and each one must be used on a cork rubber; work lengthways of the ribs, and preserve the edges absolutely square and sharp. Now square a light centre line down the bottom of the ribs, and midway of this line make a puncture which will show the position of end pin, the hole for which should then be bored with a $\frac{1}{4}$ in. bit.

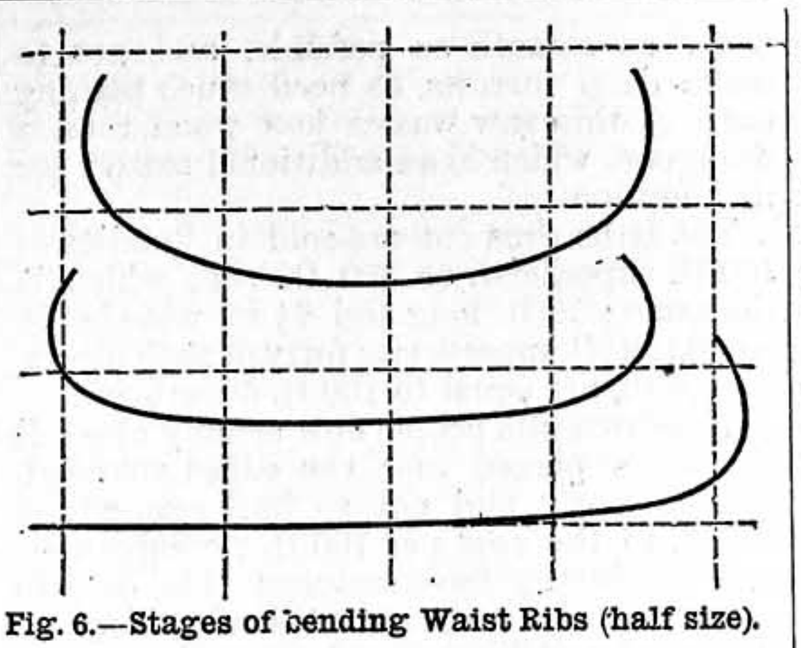


Fig. 6.—Stages of bending Waist Ribs (half size).

Marking Back and Belly from Ribs.—The ribs are now ready, and the back and belly can be marked out from them, but first place (Fig. 2, p. 5) the outside pattern to the joint of the back, and trace around it with lead pencil; turn the pattern over, and complete the outline. Next place the model, back downwards, exactly true to centre joint, and an equal distance all round from the pencil outline already traced, and fasten it in that position with an iron cramp at each end. Now correctly trace on the back the outline of the ribs with a fine pointed marker, and then remove the model, and mark out the belly in the same way as the back; but as the "tab" or "button" on the latter will not be required on the belly, the outline must therefore be continued across the top.

Sawing out Back and Belly.—Your next business is to saw these two shapes out with the bow or a fret-saw, keeping just outside the pencil mark. With the compasses draw a line all round the upper or bevelled sides of both back and belly, $\frac{3}{8}$ of an inch from the edge. Now set your cutting gauge to $\frac{3}{16}$ in. and cut a strong line that distance from the flat side, all round both back and belly. With a dovetail or fine tenon-saw, and gouges, cut away the rectangular piece thus described, and afterwards level it with a flat oval plane (J, Fig. 5) and files, finishing it $\frac{3}{32}$ in. thick. The model, with the ribs on, should again be placed in the position marked from them on the back, cramped as before, and fixed in the vice, thus fastening securely the back and the ribs together. The edges should now be reduced with files until there is a perfectly even projection over the ribs of $\frac{1}{8}$th of an inch. Be particular to make the corners match in direction as shown in Fig. 7. Remove the model from the vice, and take the cramps off; now open the compasses to $\frac{7}{16}$ in., place one point on the joint of the tab $\frac{1}{8}$ in. from the rib line, and describe a semicircle: this gives the form the tab will bear, or nearly so. In Fig. 8 will be given a back with edge reduced and ready for purfling, of which operation I shall give an account in my next paper on violin making.

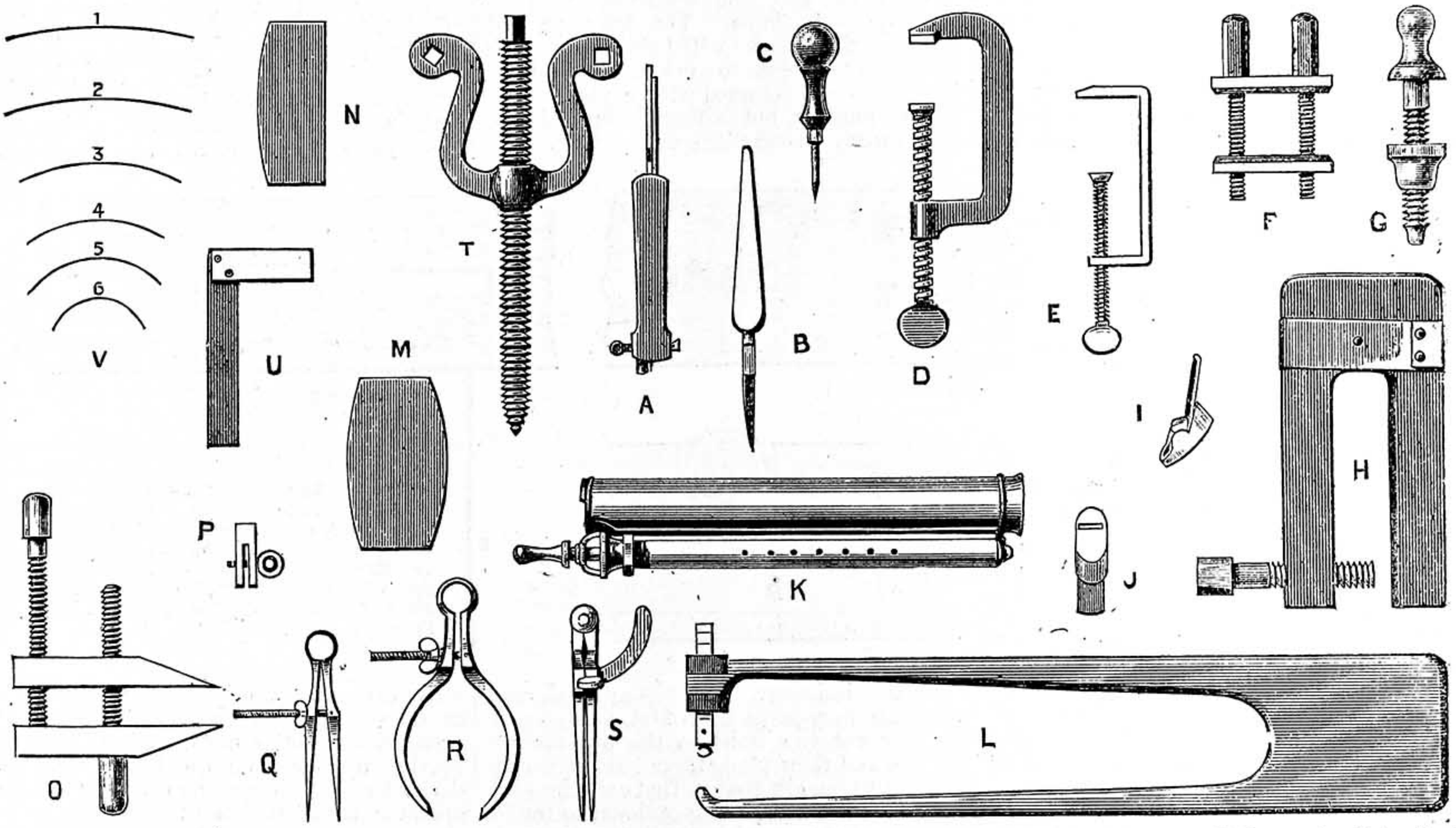


Fig. 5.—Some Special Tools used in Violin Making—A, Purfling Gauge or Cutter; B, Knife; C, Router; D, E, Iron Cramps; F, Cramp for fixing Back and Belly to Ribs; G, Cramp of Writer's Design; H, Wood Cramp; I, J, Small Iron Planes; K, Apparatus for bending Ribs; L, Thicknessing Gauge; M, N, Steel Scrapers; O, Hand Screws; P, Small Cramp; Q, Spring Dividers; R, Spring Callipers; S, Steel Compasses; T, Carver's Screw; U, Small Square; V, Sweeps or Curves of necessary Gouges.

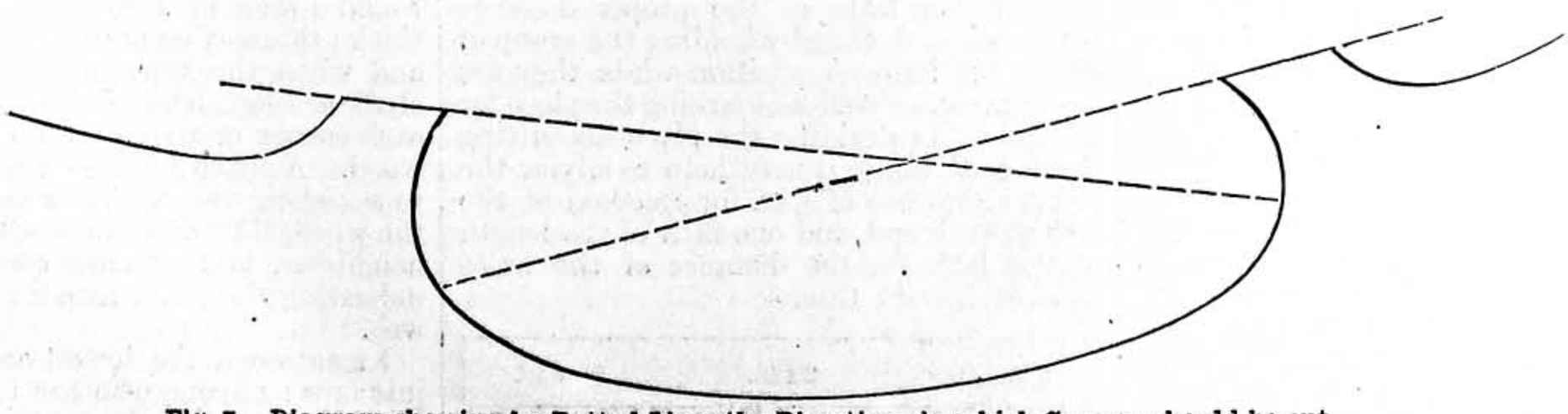


Fig. 7.—Diagram showing by Dotted Lines the Directions in which Corners should be cut.

VENETIAN BLINDS.

BY B. A. BAXTER.

PROCEDURE—MATERIAL—METHOD OF CUTTING—CONTENTS OF A BUNDLE OF 100 FT. SUPER.—LONG LATHS CANNOT BE PLANED USING AN ORDINARY BENCH STOP, BUT BY TENSION, HELD BY HOOKS—HOLES ABOUT ONE-FIFTH FROM ENDS OF LATH—NUMBER OF TAPES MUST BE TWO OR MORE FOR OVER 4 FT.—LAP OF LATHS—TAPES OR LADDERS—HOW SET OUT—STUFF FOR HEADS AND THICK LATHS—ADJUSTABLE ANGLE—HOW SECURED—PULLEYS AND CORDS—ROLLERS AND WEBS—PAINTING AND VARNISHING.

THESE blinds, once so popular, and likely again to become so, are of very simple construction, though the opportunity of making mistakes is greater than in almost any other work with which I am acquainted. Like all other work where there is a constant recurrence of the same forms or the same operations, it is necessary to observe routine methods, and to divide the work up into as many separate portions as possible, each portion requiring but few tools, and each also being easily mastered. It is not necessary to give these varied operations to separate workers, though in shops where boys are employed, they, of course, do the simplest portions of the work; but it is necessary to divide the work up into parts, and do each part before another is begun, or confusion will result from the want of method.

The wood of which Venetian blinds are made is American pine—that variety which, when exposed to the air, takes a pinkish tinge being preferable; and it should be free of knots, shakes, sap, or resin—resin, that is, that looks as if a knife had been inserted into the wood, and the opening made thereby filled with a glutinous stopping.

The qualifications of pine for this work are its lightness, straightness of grain, and ease of working, and its standing the heat of the sun, which, behind glass, is often considerable.

Pine, as most of our readers know, is usually in planks 11 in. by 3 in.; for blinds, however, the saw-mills proprietor is more concerned about quality than dimensions—smaller timber will do, if good. Supposing, however, the stuff is 11 in. by 3 in., it is first reduced to 2½ in. (this is the usual width for blind laths, for reasons which will be explained presently); then it is cut down the centre, and then cut after cut is made, so as to remove pieces 2½ in. wide and ⅕ in. thick. This is the ordinary thickness, and the saw used is a circular saw, ground so that it is thin at the edge; the teeth are small and the set slight, so as to leave the wood as smooth as possible, and not to make deep furrows, to need much planing out. A thin saw wastes less wood than a thick one, which is an additional reason for its adoption.

The laths thus cut are sold in bundles of 100 ft. superficial, or 480 ft. run, which is the same; 12 ft. long and 2½ in. wide being equal to 2½ ft. superficial; forty of such pieces, therefore, are equal to 100 ft. superficial.

The saw-mills people now usually also sell the laths planed and the edges rounded. This formerly, and not so long ago, added 3s. 6d. to the cost per 100 ft.; competition and machinery have reduced this of late years, but the laths are still advertised as "hand-planed"; and sometimes they are.

When planed in long lengths, blind laths are too thin to resist the strain of planing, so they are held by two or three brads or wire nails driven into the rear end of the bench nearly as far as the heads, which are cut off, and the remainder filed to the necessary shape. The laths pressed down on these hooks will hold well enough for a finely-set plane to work well upon them. The edges are rounded with a plane made for the purpose, but failing the special tool, an ordinary ¼ bead plane will do well.

If the laths are bought unplaned, the workman may plane them first, as above, or he may cut the laths to the appropriate lengths and then plane them; it is scarcely needful to remark that in that case the filed hooks are not used. It is optional to round the edges before or after the flats are planed, but very often the laths are cut to the proper lengths, then the edges planed with a jack-plane in groups of about twenty-five at a time in a trough made for the purpose; then the flat surfaces planed and the edges rounded. The holes for the passage of the cord used to be made with a gouge, preferably one ground inside; but for those who mean to make any considerable number of blinds, a punching press, of which many suitable patterns are made, is a necessary investment. When the gouge is used, a bradawl is put through the laths at the proper distance from each end, thereby holding the group of about six laths in position while they are being sawn, as well as marking the place for the hole. In deciding the place for cutting these cord holes, it may help to advise the usual allowance of ½ in. for freedom of the lath at each end, and one-fifth of the length of the lath for the distance of the holes from each end: thus—

8 in. ()	24 in.	() 8 in.

40 in. lath for a 41 in. opening.

It is customary to have three tapes, and consequently three holes and cords, to all blinds over 4 ft. wide; and Venetian blinds for shop windows may well have four, or even more, tapes and cords, according to their size.

As a Venetian blind must be fixed together in such a way that it can be drawn up, and so that the laths lap or cover each other, laths 2½ in. wide are usually placed 2 in. apart—six to the foot. Tapes or webs, with cross-pieces sewn at intervals, are needed.

These tapes, or ladders, as they are sometimes called, are made of a webbing intended for the purpose; and before Carr's patent woven web appeared in the market, the making of the tapes was the great difficulty in the way of beginner or amateur, but now the patent woven ladder webs make blind making possible to anyone who can use wood-working tools and a paint-brush.

To those who wish to know how the blind makers of a former time managed, I may say that the tapes were tacked temporarily on a board, to the edge of which a strip of wood was affixed. This strip we divided carefully with compasses into parts 2 in. between the lines, and other distances on other sides of the strip, or on other strips which did duty upon occasion when other distances were needed. Having the tapes on the board, and the divided strip visible on its further edge, the operator transferred the marks with a T-square and pencil; only a little care to stretch the web equally tight was needed to ensure a satisfactory result. It is evident that the worker could allow the proper distance for the lowest and thicker lath by this way of marking the tapes, in which respect only the old way was superior; but the woven web may be recommended to all amateurs and beginners, notwithstanding that the folding of the cut ends of the web are a slight difficulty.

The narrow tapes, about ⅜ in. wide, are usually set out by winding the material round a piece of wood 2½ in. wide and ¾ in. thick; this may be of any convenient length, and when the tape is neatly wound, red chalk or black lead is slightly rubbed along each corner or arris of the covered strip of wood. A sharp knife or chisel is then used to cut along the centre of the ¾ in. edge of the wood, thus dividing each strap from its neighbour, and leaving each with marks indicating the place to sew on to the wider web.

I mentioned the lowest and thicker lath just now: anyone who has seen a Venetian blind knows that it contains thin laths,

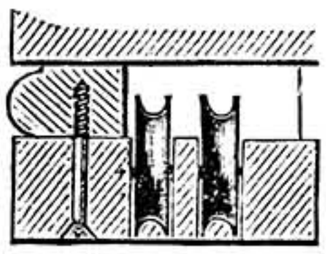


Fig. 1.

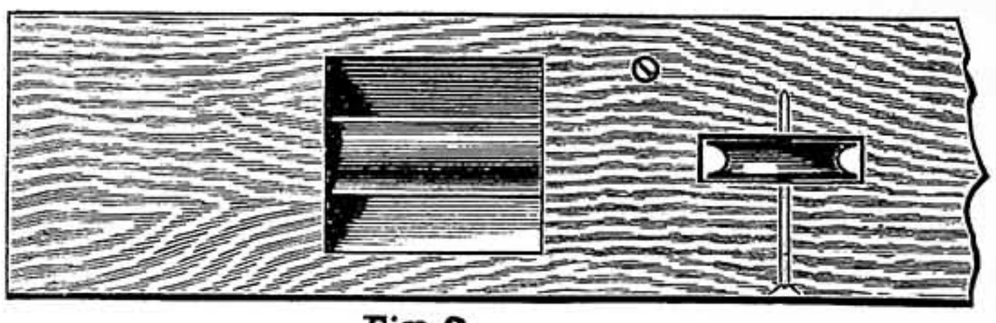


Fig. 2.

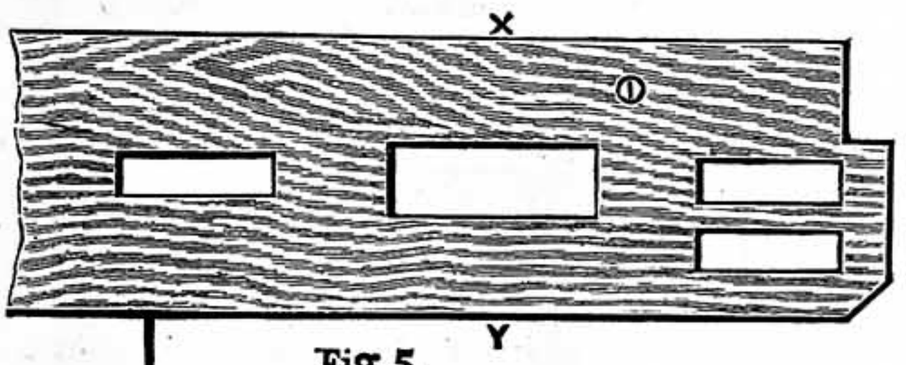


Fig. 5.

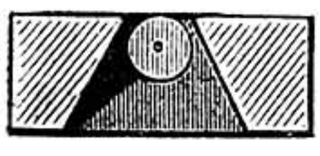


Fig. 3.

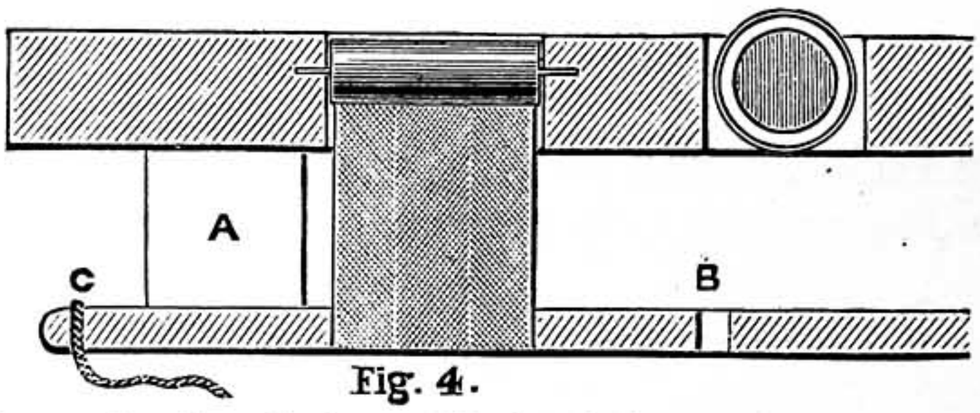


Fig. 4.

Fig. 1.—Section of Pulley Lath through Pulleys. Fig. 2.—Underside of Pulley Lath, showing Pulley and Roller. Fig. 3.—Section of Pulley Lath through Roller. Fig. 4.—Section through both Pulley and Roller, showing Position of Cord (B) and Spacing Block (A), and Cord (C) to alter Angle of Lath. Fig. 5.—Right-Hand End of Lath, showing Relative Positions and Sizes of Mortises—B, Centre Line of Cord; X, Front; Y, Back.

varying in number according to its length, and two stouter laths, one at the bottom and one at the top, to which the tapes are affixed, the whole being suspended to the head or pulley lath, as it is variously termed; 4 cut stuff is about right for these thicker laths, and 1 in. or 2 cut for the head or pulley lath. "4 cut stuff" is a technical term. It means that the plank has four cuts in it, thus making five boards about $\frac{5}{8}$ in. thick.

In order to give adjustment of angle to every lath in the blind, there are rollers let into the pulley lath, the axes of which are paraliel to the edge of the lath. The movable laths rest in the tapes affixed to the stout lath at the top, which is fixed to the pulley lath by webs passing over the aforesaid rollers, and parallelism of the whole (which is important) is secured by using a spacing block, or a pair, between thick lath and pulley lath, while the web is drawn over roller and lath and tacked in its place.

Before we proceed to paint our thin laths, we must take off with some glass-paper the fibre or rough edge left at the ends of the laths by the saw. This is usually done a number at a time, and the group of thin laths can be held in various ways so as to secure contact with the glass-paper on each edge of the ends in turn.

The probable reason why $2\frac{1}{2}$ in. has been universally chosen as the ordinary width for Venetian blind laths is because that is the widest that could go between the beads in $1\frac{1}{2}$ in. sashes, and that width of lath has become universal, because variations in width would be inconvenient.

The blinds are drawn up by cords passing over pulleys; the axes of the pulleys are at right angles to those of the rollers just mentioned, and by a simple method the cords are made to draw up—in most cases at the right-hand of the window—while the cord that slopes the laths at pleasure is usually at the left hand.

In the diagrams that accompany this description this will be seen, and the arrangement of pulleys and rollers made clear.

The pulley laths serve the double purpose of fixing the blind, and also form the place of attachment for the pulleys and rollers. Reference to Fig. 1 will show how these pulleys are arranged so as to escape contact with the sash beads. The outer beads are usually $\frac{5}{8}$ in. by $\frac{7}{8}$ in., therefore the foremost of the two pulleys should be quite that distance from the front. The pulleys are made of various sizes, but 1 in. diameter is the most useful size for all but the smallest blinds. The mortises for the pulleys are generally cut with a $\frac{3}{8}$ in. chisel.

The rollers are seen in Figs. 2, 3, and 4, and are cut with a $\frac{5}{8}$ in. or $\frac{3}{4}$ in. chisel; the length is about $1\frac{3}{4}$ in. The lower side of these mortises must be enlarged, as shown in Figs. 3 and 4, because the web which passes over the roller also passes over the lath, which is $2\frac{1}{2}$ in. wide.

The figures also show how the pulleys and rollers are centred, the latter needing the wire to be let into a mortise cut for its reception. This is shown in Fig. 4. The holes for screws for fixing must not be forgotten, as it is most inconvenient to find no screw-holes when you have the blind put together and are about to fix it. Figs. 2 and 5 show suitable places for screws.

The stout laths which form the top and bottom laths, and to which the tapes are secured, have cord-holes corresponding to those in the thin laths, but those in the top are larger than those in the bottom, which are small enough to retain the knot in the cord, neatly covered by the tape, and resting in a countersink made in the bottom of the bottom lath.

We have now our blinds cut to size, and the cord-holes cut or punched; they are, of course, planed, rounded, and the edges of the ends and corners rubbed with glass-paper. We will now paint or varnish them.

In painting blinds we must guard against the use of too much oil; no boiled oil must be used at all, on any account, and the first coat of colour the laths receive is very frequently composed of size and whiting. This should have no water added to the size, which should not, in melting, be allowed to boil. When well melted, the whiting should be crushed and stirred in gradually; and not a great deal is needed, or the mixture will be too thick to put on easily, and will dry with coarse brush-marks. The painting of blind laths needs a quick and light touch, or some of the laths will be broken. A 000 or 0000 brush is suitable—oval brushes are preferred by many—and the lath, while being painted, is held by the left first finger and thumb at the hole in the lath, the other end resting on the board fixed on the painting bench. The paint which follows the size colour may be ordinary *raw* oil colour, rather sharp, and still more turps for the finishing coat.

For varnishing, two coats of patent size of best quality—vellum size for choice—the first coat of which may have some water added, and the second some, but less. The varnish may be best church oak, and blinds should have two coats of varnish, pure as received from the maker.

The arrangements for drying the laths differ, but the general plan is to fix a piece of quartering, in which is driven pieces of the stoutest iron wire (about $\frac{1}{4}$ in. diameter), about 15 in. or 16 in. long and about $4\frac{1}{2}$ in. apart. Each of these will hold about ten laths, and the whole arrangement of quartering and wires is fixed on the wall horizontally, and higher than the eyes of the workmen.

I need say nothing about the putting together and fixing, because anyone who can do the preceding work can easily overcome the remaining difficulties, but one word of warning must be uttered: do not, in putting in the cords, allow the cord to depart from its true course, which is down the centre of the wide tapes, and therefore alternately to the right and left of the short tapes on which the laths rest. If you make any mistake, rectify it at once; do not treat it as a matter of indifference, for a cord inserted in the wrong way will do mischief to itself and the tapes until it is put right.

Lastly, as the parallel position and equal spacing of the thin laths depend on the accuracy of the tapes, so the spacing and parallelism of the lowest lath depend on the care with which it is tacked in its place. The absence of attention to this trifle makes a great difference in the appearance of the finished work.

After a trial or two the making and finishing a Venetian blind will not be found so difficult as it may seem at first sight. It will be a good practice for anyone who has in his possession, or can become possessed of, an old blind to take it to pieces and put it together again. From this point of view it follows as a matter of course that any paper will prove useful to those who merely wish to clean the blinds or even to furnish them with new tapes. In taking a blind to pieces for the first time, due regard should be paid to the construction and arrangement of the cords.

HOW TO MAKE A QUARTER HORSE-POWER STEAM ENGINE.

BY F. A. M.

THEORY AND ACTION OF THE SLIDE-VALVE.

ENGINES NOT MADE SELF-ACTING AT FIRST—THE PLAIN SLIDE-VALVE WITHOUT LAP—SLIDE-VALVE WITH LAP FOR EXPANSIVE WORKING—STROKE OF THE ECCENTRIC—LEAD OF THE VALVE—ANGLE OF ADVANCE, OF ADMISSION, OF EXPANSION AND RELEASE, OF EXHAUST AND COMPRESSION — INSIDE LAP — USE OF LEAD—LINEAL ADMISSION AND EXPANSION IN PARTS OF THE STROKE—HOW TO ARRANGE FOR MORE EXPANSIVE WORKING—HIGH RATE OF NO USE IN UNJACKETED CYLINDERS — LIST OF CASTINGS AND TOOLS REQUIRED FOR MAKING THE ENGINE.

The Slide-Valve.—It would be quite possible to put together the engine we have in hand without any directions beyond those which accompany the drawings; but no amateur engine-maker will be content to be ignorant of the action of so vital a part of the machine as the slide-valve, nor of so beautiful and ingenious an adaptation of means to an end—a problem which may well be considered as a kind of *pons asinorum* in steam engineering. Besides, if we do not master the slide-valve, we cannot certainly go on to deal with link motion or expansion gear.

It may not be generally known that the first steam engines required a man, or boy, constantly beside them, to turn on and off at every stroke the cocks which directed the steam into and out of the cylinder. We can hardly imagine such a state of things in these days; but it continued until a boy, who wished to exchange work for play, had ingenuity enough to connect by strings the handles of the cocks with some of the moving parts of the engine, in such a way that the engine did for him the work he was set to do—a real invention, for he had made the steam engine *self-acting*.

The distribution of steam in the modern engine is controlled by the eccentric and slide-valve — a beautiful and smoothly working arrangement, almost perfect in its action. The eccentric is keyed upon the shaft and gives motion to the slide-valve, so that, no matter what may be the position of the piston in the cylinder, the slide-valve will always be, of necessity, in the correctly corresponding position. The steam is led from the boiler into a steam-chest, or valve-box, upon the side of the cylinder, and the duty of the valve is to direct the steam upon the back of the piston to drive it up the cylinder for three-quarters of the stroke; then to stop the supply till the piston reaches the end, and then to bring the steam upon the front face of the piston to drive it back, whilst it allows the first cylinderful of steam to escape by the exhaust pipe.

Looking at Fig. 1, the valve V and the ports or steam-ways P, P,' will be seen in section, leading the one to the top and the other to the bottom of the cylinder (called top and bottom merely for convenience of description). There is a third port between the other two called the exhaust port, E, which is *always covered* by the slide-valve, and through this the steam makes its escape; the pressure under the valve, therefore, will be the same as that in the exhaust pipe which opens into the air, whilst the pressure upon the outside of the valve is 50 lb. per square inch, or whatever may be the pressure in the steam pipe which supplies steam to the box in which the slide-valve works. The valve fits so perfectly upon the face that only the merest whiff of steam—a hardly

perceptible quantity—can pass between the surfaces, and the same is true of the fit of the piston in the cylinder. All that escapes in either of these places is loss, and, if well and carefully fitted, there need be no loss. The difference of the pressure outside and inside the valve causes it to be held up firmly against the valve-face on the side of the cylinder. The figure also shows the eccentric which moves the valve, but this is drawn as if it were turned a quarter round, so as to show its flat side instead of its edge.

We may now pass on to Fig. 2 and investigate the action of the plain slide-valve without lap. At Fig. 2*a* will be seen the valve which belongs to Fig. 2. Lay a piece of tracing paper over Fig. 2*a*, and trace the valve with the base line to *h*, and the verticals *g*, *h*, and *k*. Lay this tracing on Fig. 2 and see that these vertical lines correspond with those of the figure beneath, whilst the edges of the valves *a b*, *c d*, coincide with the edges of the ports A B, C D; thus the valve will be in the middle of its course, whilst the point *g* on the tracing will coincide with *z*, the centre of the circle representing the movement of the eccentric. Evidently the ports are all closed and no steam can pass anywhere; the piston then must be at one end of its course. Let us place the crank upon the line *z r*, and suppose the piston to be at the top end of the cylinder. Looking at the valve, we see that whether the crank moves upwards or downwards from *r*, the valve must move to the left so as to uncover port P to the steam and port P′ to the exhaust; if then the crank is to go round *upwards* from *r*, the eccentric must be fixed at *s*, but if the crank is to go *downwards*, and go round as a watch does (forwards), then the eccentric must be placed at *t* to make the valve move to the left. *Fix the eccentric at t, and the engine will run forwards; fix it at s, and it will run backwards.*

Thus we arrive at this conclusion: that when the edges *a b*, *c d*, of the valve are the same width as the ports, the eccentric must be keyed at an angle of 90 degrees *in front* of the crank.

Let us now suppose we determine that the engine shall go forwards and the crank go downwards from *r*. Suppose it to move one-quarter round from *r z* to *y z*, then the eccentric will have moved from *t* to *v*, and the valve will move to the left while the eccentric passes round the quarter circle till the point *g* coincides with *v*, *d* with C, and *b* with A. The piston is now in the middle of its course, moving at its greatest velocity, and the valve has been opening both steam and exhaust openings wider and wider till they are now opened to their widest extent. Continuing the movement through another quarter circle, the crank continues its course till it arrives at R *z*, bringing the piston to the bottom end of the cylinder, whilst as the eccentric passes over the arc *v s*, the valve returns again to its former central position, gradually closing the steam and exhaust openings as the piston comes gradually to rest. Now, however, though the valve is in its first position, the crank is at R and the eccentric at *s*, and therefore the further movement of the crank and eccentric will cause the valve to move to the right of its central position, opening port P′ to the steam and port P to the exhaust, so that now the direction of the steam is reversed, it flows into the back end of the cylinder, and the steam which did the work during the last stroke escapes under the valve to the exhaust.

Fig. 2, with the tracing of Fig. 2*a*, will enable the student to find the corresponding position of the valve for any position of the crank. It simplifies the problem by getting rid of the eccentric rod, the angularity of which is so slight that the error thus introduced is unappreciable.

Having now studied what may be called the rudimentary slide-valve, which would only be suitable for a water engine, we will proceed to show how by altering its dimensions its working may be greatly improved.

A great fault in the arrangement of the valve of Fig. 2 is that it does not allow the steam to be used expansively. Without going deeply into the subject, it must be evident that, with the valve just considered, the steam will continue to enter the cylinder and drive forward the piston to the very end of its stroke, and that then the exhaust valve will allow the whole cylinderful of high pressure steam to escape, though it has in it power enough to do a great deal more work. Suppose, instead of this, we had arrested the flow of steam into the cylinder when the piston had only travelled through half its stroke, the half cylinderful of steam, say at 40 lb. pressure per square inch, would have begun to expand, and would have continued to press forward the piston until it arrived at the end of its stroke, when, having doubled its volume, its pressure would have fallen to one-half (reckoning from vacuum) what it was at first. By this means half as much steam would have been made to do almost as much work as the whole cylinderful.

There are, however, practical reasons why it is not well to carry the system of expansion very far in a small unjacketed cylinder like the one we have before us, and the limit has been fixed at three-quarters—that is, the proportions of the slide-valve have been arranged in such a way that when the piston shall have travelled over three-quarters of its stroke, the ingress of more steam shall cease, and the remainder of the stroke be completed whilst that steam expands. The arrangement saves at every stroke one quarter of a cylinderful of steam, and the average pressure is reduced about 2 lb., whilst the terminal pressure falls to three-quarters of the initial. How this is done can be seen by referring to Fig. 3, which, with its valve, represents the arrangement and proportions actually adopted. The letters of reference are the same as in the former example, and the tracing of the valve, Fig. 3*a*, should be made as before. Laying this second valve tracing on Fig. 3 in its middle position, we notice that whilst the points *b* and *c* on the valve coincide as before with edges B and C of the ports, edges *a* and *d* of the valve *overlap* the port opening by a distance D *d*, A *a*, equal to the width of the port opening; this distance of overlap is an important dimension, and it is called *the lap* of the valve; in this case we should say we have one port of lap.

Let it be noticed that the valve is not, when in its middle position, properly placed to begin to admit steam through port P so that the piston may begin its "in" stroke; it will not do this till the valve has moved to the left, until edge *d* reaches edge D. Moreover, it will not have opened the port fully till edge *d* reaches edge C. Supposing we wish to arrange the valve to open this port fully, we must make the radius of the circle of the eccentric equal to the distance *c* to *d*, or *a* to *b*; and since in our case we have made the ports $\frac{1}{4}$ in. wide, this radius will be $\frac{1}{2}$ in., and the eccentric will have an eccentricity of $\frac{1}{2}$ in., and the stroke of the eccentric and valve will be 1 in., which is the way the size of the eccentric circle on Fig. 3 was determined. To find the proper angular position for the centre of the eccentric upon this circle, move the valve to the left till edge *d* has just passed edge D by the thickness of a visiting-card, say $\frac{1}{64}$ in.; this distance is called *the lead* of the valve. Now observe where the line *g h* on the tracing cuts the eccentric circle at *t*, join *t z*, and produce the line to *s*; *t* is the position the centre of the eccentric must occupy when the crank is at *r* ready to begin the "in" stroke, and the angle *r z t* is called *the angle of advance*. It is the angular distance by which the eccentric precedes the crank; in this case, were it not for the slight addition made to it by the lead, this angle would be 120 degrees. We may now, by the help of our diagram, watch the action of the valve, and determine at what points in the revolution of the eccentric the inlet and outlet of the steam occurs. Beginning at *t*, the valve edge *d* having just passed D let the eccentric move on to *v*, and *d* to C; here the valve is fully open; pass on from *v* to *p* (determined by the edge *d* reaching D), and the valve closes and stops the admission of more steam; *t z p* is *the angle of admission*. By dropping from *p* the perpendicular *p p′* upon the diameter *t s*, we find that if the distance *t s* represents the length of the stroke, then distance *t p′* represents that part of it during which steam is admitted. Let the eccentric continue its course from *p* to *o*, and the valve will reach its middle position; but here another event occurs. Edge *c* of the valve passes edge C of port P, which opens it to the exhaust; the steam that was expanding in the cylinder will therefore escape when the eccentric reaches the angular position *o*, and the piston the position corresponding to *o′*, whilst the stroke does not end till the point *s* is reached at 180 degrees from *t*; angle *p z o* then is *the angle of expansion*, angle *o z s the angle of release*; if *t s* represent the length of the stroke, then *t p′* is the admission, *p′ o′* the expansion, and *o′ s* the release. Following the eccentric round from *s* through *w* to *n*, we note that at *s* the piston begins its return stroke, which ends when the eccentric reaches *t*; but that, just as the exhaust begins at angle of *o z s* before the completion of the stroke, so in like manner the exhaust ends at *n* before the exhaust steam has been completely expelled. Dropping a perpendicular from *n* to *n′*, we find that if *t s* represent the length of the stroke of the piston, then, when it shall have returned from *s* to *n′*, the port P will be closed to the exhaust, and during its remaining course from *n′* to *t* it will *compress* the exhaust steam remaining in the cylinder, which will have the effect of raising its pressure; so that when, just before the next stroke begins, the port P opens to the steam again, this high pressure steam will not have to fill a port-way and cylinder-end at atmospheric pressure, but will find there already a pressure of some 15 or 20 lb. The angle *n z t* then is called *the angle of compression*; it is a decided advantage to the engine. Moreover, the angles of release and of compression can be varied: we can take from one and add it to the other by simply adding to or reducing the distance *b* to *c*. Suppose a little piece *m* (Fig. 3*a*) to be fitted inside the valve, and watch its effect; it will move the points *o* and *n* on the eccentric circle a little further to the right; it will take a little from the release and add it to the expansion, and,

by the same amount, it will increase the compression. Such a piece added as at *m* would be called *inside lap*; it is sometimes used, but the more usual practice is to make *b c* equal to B C.

The use of the lead is to take up the looseness of the joints of the connecting-rod ends, and so to prevent any knock on the dead points. It will be understood that as the force of the steam urges the piston first in one direction and then in another, if there were the slightest amount of play anywhere in the joints, between the piston and crank, the pins would be forced first to one side and then to the other of each joint, causing a disagreeable thump at the beginning of each new stroke, at the moment the steam came on to the piston. By means of the lap, and also with the help of the compression, the motion of the piston is retarded at the end of each stroke, so that the momentum of the fly-wheel takes up all looseness in the joints, in such a way that the pressure of the fresh steam is transmitted solidly to the crank-pin. When this is properly done in every respect, not the slightest knock or thump will be heard as the engine piston reverses its movement in the cylinder.

If it be required to find at what parts of the stroke in inches the various incidents take place, the eccentric circle in Fig. 3 can be surrounded by another circle, as seen dotted in the figure, having a radius equal to that of the crank—$2\frac{1}{8}$ in.—and the various angles of the eccentric positions can be produced to the circumference of the larger circle, and perpendiculars let fall upon its diameter; these perpendiculars will now mark off the different parts of the stroke in inches. By this method it was found that, the stroke being $4\frac{1}{4}$ in., the admission occupied $3\frac{3}{16}$ in., the expansion $\frac{3}{4}$ in., and the release $\frac{5}{16}$ in.

It may now be said, that as the ports are, of necessity, made large enough to give free exit to the exhaust steam at atmospheric pressure, it is not necessary that they should be fully opened to admit the high-pressed steam; we can, therefore, if we like, employ an eccentric with only $\frac{3}{8}$ in. eccentricity. We shall leave it to our readers to work out the full results of this change, only stating that the angle of advance will be increased by about 8 degrees. The cut off will occur soon after the half stroke has been passed, and the ports will never open more than $\frac{1}{8}$ in.—one-half their width. The arrangement would be a good one; it would use less steam and give out but little less power than the one already examined. Economy in so small an engine is not of much consequence. Possibly it might amount to a saving of a penny a day, and readers might do well to adopt it if they can afford to sacrifice a little power, or if their boiler is deficient in steaming capacity. An expansion of one-half is about the limit of what can be obtained by the single slide-valve. Even with that amount the release and the compression grow to rather formidable proportions. If we wished to work still more expansively, we should have to employ a second eccentric to work a second slide-valve, moving upon the back of the first, and by this means the expansion might be carried to any degree desired. It is, however, no advantage to use a high degree of expansion in a cylinder not provided with a steam jacket; and the very small amount we might hope to save in so small an engine does not make it worth while to incur so much extra expense and complication.

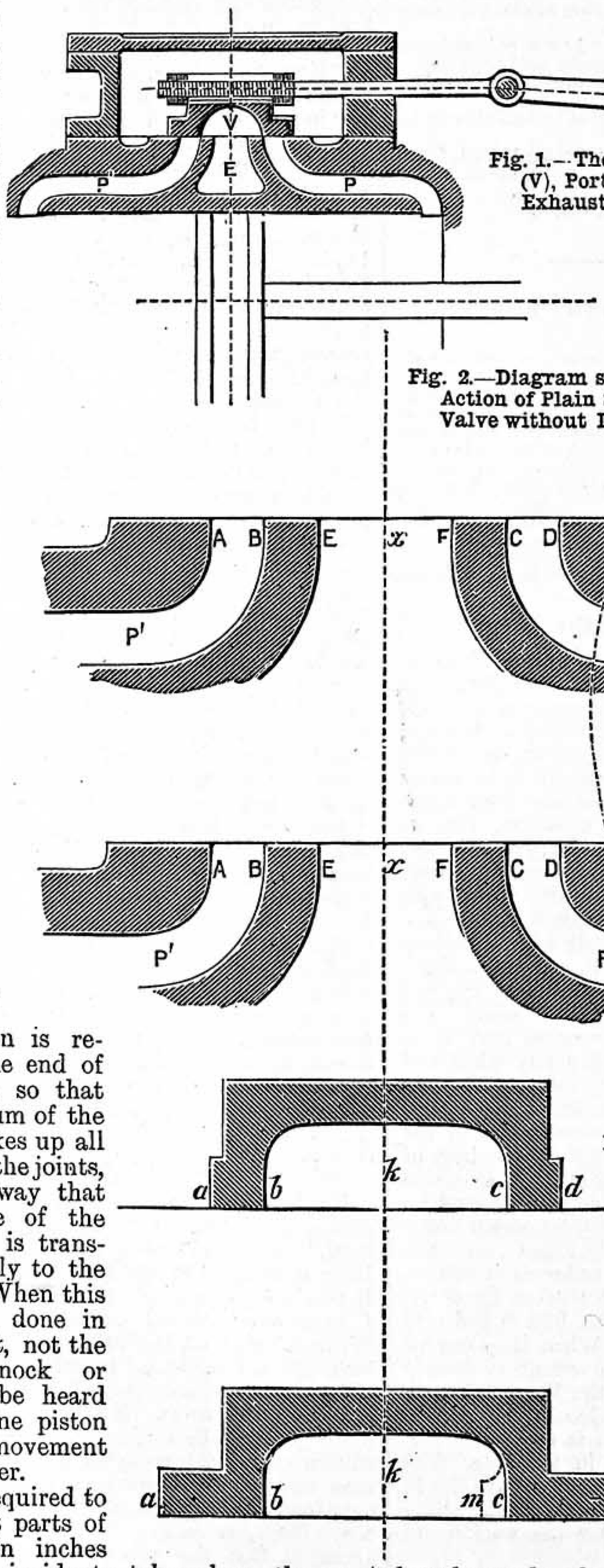


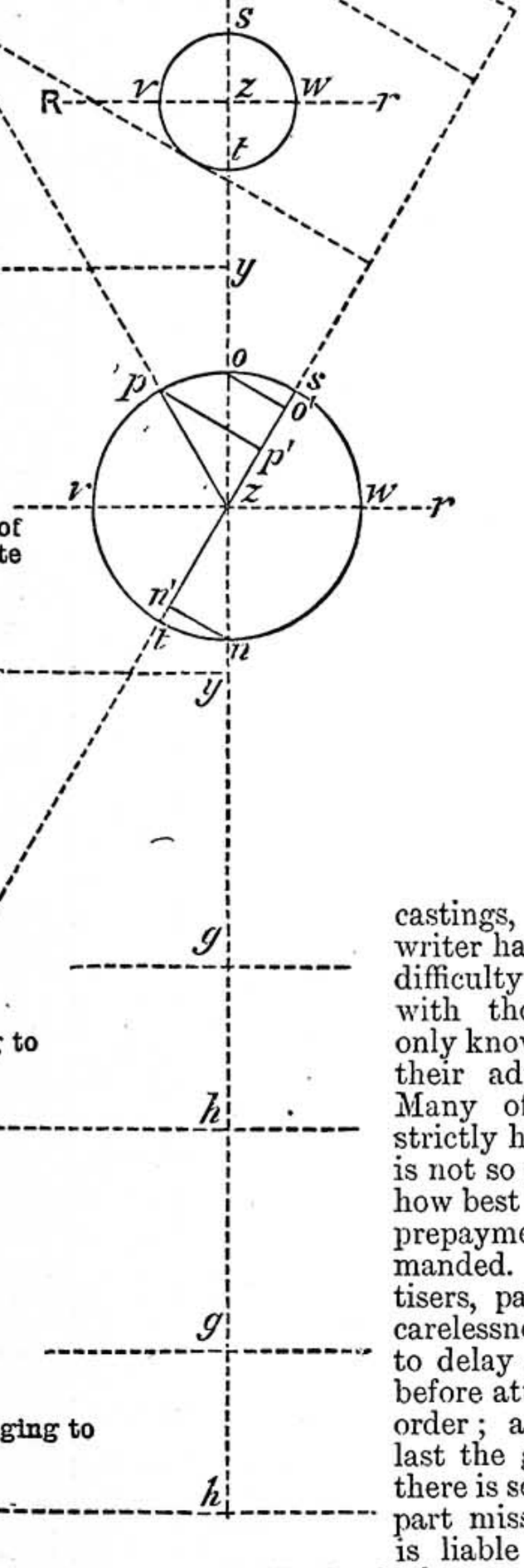
Fig. 1.—The Slide-Valve, showing Valve (V), Ports or Steam-Ways (P, P'), and Exhaust Port (E).

Fig. 2.—Diagram showing Action of Plain Slide-Valve without Lap.

Fig. 2a.—Valve belonging to Fig. 2.

Fig. 3.—Arrangement of Valve to promote Saving of Steam.

Fig. 3a.—Valve belonging to Fig. 3.



List of Castings supplied, and of Tools required, for making the $\frac{1}{4}$ H.P. Engine.

In buying castings, the present writer has found some difficulty in dealing with those who are only known to him by their advertisements. Many of these are strictly honest, but it is not so easy to know how best to deal when prepayment is demanded. Some advertisers, partly through carelessness, are apt to delay a long while before attending to an order; and, when at last the goods arrive, there is some essential part missing. If one is liable to such annoyances in England, how much more so in the Colonies! It is with a view of preventing such annoyance to those readers of these papers who might wish to obtain a set of castings, that a set of excellent patterns have been made. From these, as soon as it is practicable, castings will be made by a man on whom some of us think we can depend. So that it is hoped that the owners of the patterns will soon be in a position to execute orders for them from all parts of the United Kingdom, the Colonies, or anywhere else, and to forward the cast-

ings complete, without unreasonable delay. Of this, however, due notice will be given by advertisement in WORK.

Another great annoyance to a would-be engine builder is to find himself suddenly pulled up by the want of some little forging it was supposed he would be able to make, or of a bit of brass rod to make some small part for which no casting has been supplied. To avoid this, castings are provided of many very small parts which might have been made of a bit of brass rod, if the workman happened to have a suitable piece, but, for want of which, he might have had to wait. Our readers' patience will be sufficiently tried if they undertake this piece of work without any disappointment of such a kind, and an attempt has been made to save them all unnecessary trouble.

The first list, here following, is that of all castings and materials required to *make the engine alone*, without either pump or governor.

LIST OF CASTINGS AND MATERIALS FOR MAKING ENGINE ALONE, WITHOUT PUMP OR GOVERNOR.

No. of Pattern.	*Description of Casting.*	*No. of Castings.*
1	Bedplate	1
2	Cylinder	1
3	Top Cover	1
5	Bottom Cover	1
6	Piston	1
7	Piston Bottom	1
10	Steam Chest	1
12	Steam Chest Cover	1
15	Crosshead	1
17	Fly-wheel	1
18	Crosshead Guides	2
28	Angle Bearings	2
29	Caps for do.	2
34	Eccentric	1
35	Ecc. Half Strap (rod end)	1
36	do. do. do. (outer end)	1
	All the above in Cast Iron.	
4	Gland for Cylinder Cover	1
8	Piston Rings	1
9	Piston-rod Nut	1
11	Gland for Steam Chest	1
13	Slide-valve	1
14	Valve-rod Nuts	4
30	Bearing Brass (bottom)	2
31	do. do. (top)	2
32	Con.-rod Brasses (small)	4
33	do. do. (large)	2
	All the above in Gun Metal.	
16	Connecting-rod	1
38	Valve-rod	1
39	Eccentric-rod	1
	These three in Malleable Cast Iron.	
	1 Crank Shaft in Wrought Iron.	

With the above, 5 Stauffer lubricators, smallest size; one ⅛ in. brass screw stop valve with nipples to fit.

CASTINGS REQUIRED FOR FEED PUMP.

No. of Pattern.	*Description of Casting.*	*No. of Castings.*
19	Pump Body	1
20	Pump Cover	1
21	do. Gland	1
22	do. Union Nut	1
23	⅛ in. Spindle-valve	1
24	5/16 in. do. do.	1
25	Pump Plunger	1
26	Liner for do.	1
	All the above in Gun Metal.	
27	Pump Eccentric Rod	1
	Of Malleable Cast Iron.	
35	Half Strap of Eccentric for Pump	1
36	Other half of do. for do.	1
37	Pump Eccentric	1
	Of Cast Iron.	

CASTINGS, ETC., REQUIRED FOR GOVERNOR.

40	Governor Bracket	1
43	do. Balls	2
	Of Cast Iron.	
41	Governor Sleeve or Body	1
42	Do. Pivot Pin	1
44	Driving Pulley	1
45	Throttle-Valve	1
46	Do. do. Case	1
47	Do. do. do. Gland	1
	Of Gun Metal.	

Other Materials: Four inches of ¼ in. steel tube ⅛ in. bore. One pair of 1 in. brass mitre wheels.

TOOLS REQUIRED TO MAKE THE ¼ H.P. ENGINE.

1. A metal turning lathe, with slide-rest, is necessary; if the fly-wheel is to be bored, it must have a gap capable of taking in a diameter of 16 in. If it is not a self-acting lathe the cylinder had better be ordered ready bored. The lathe should not be less than 5 in., or at least 4½ in., centres.
2. A universal chuck three or four inches in diameter is desirable.
3. A face-plate chuck 8 in. to 10 in. diameter is necessary. It must have dogs and bolts.
4. An angle-plate chuck to bolt on the face-plate.
5. A vice. A 10s. 6d. parallel vice might do, but a larger one would be better.
6. A set of flat and round files and some cold chisels.
7. Screwing tackle, a screw plate and taps up to ¼ in. or 5/16 in., a stock, and dies for brass gas-threads.
8. A set of straight flute or Morse twist drills up to ⅓ in. with drill chuck.
9. A drill gauge is very useful; it costs 12s. 6d. from Churchill's, and contains a number of holes from 1/16 in., up to ½ in. rising by 1/64 in.
10. A surface-plate and scribing block.
11. Squares and callipers.

OUR GUIDE TO GOOD THINGS.

*** *Patentees, manufacturers, and dealers generally are requested to send prospectuses, bills, etc., of their specialities in tools, machinery, and workshop appliances to the Editor of WORK for notice in "Our Guide to Good Things." It is desirable that specimens should be sent for examination and testing in all cases when this can be done without inconvenience. Specimens thus received will be returned at the earliest opportunity. It must be understood that everything which is noticed, is noticed on its merits only, and that, as it is in the power of anyone who has a useful article for sale to obtain mention of it in this department of WORK without charge, the notices given partake in no way of the nature of advertisements.*

9.—BLACK'S PATENT FASTENER.

MR. ALEXANDER BLACK, High Street, Cowdenbeath, N.B., has produced a new kind of fastener for shirt studs, a specimen of which he has sent for inspection, and which seems likely to be useful to those who wear shirt-studs, solitaires, etc., as the patent fastener enables the wearer to insert and remove them with the greatest ease, and absolutely without injury to the linen. The fastener can be fitted to any size or form of stud; and Mr. Black claims for his invention that it is more secure when inserted than any other, and forms, with the top, one piece only; thus overcoming a difficulty never successfully met hitherto. In Fig. 1 is shown a representation of the stud when about to be inserted in the hole or holes made for its reception; Fig. 2 shows a side or sectional view of the appliance. It is used by inserting the ribbed end A of the fastener under one lip of the button-hole (as in Fig. 1), and then pushing it first to the right as far as it will go, and then to the left under the other lip of the hole, or in other words, to the left in order to bring B under the other lip. When it is desired to remove the stud, the movement is simply reversed. The spring clips the linen firmly in inserting and removing, and closes or locks when the stud is in position. There is no wear to the linen from the stud revolving in the hole. The neck being flat, it cannot turn, and always lies in position to be readily removed. The more stiffly starched the linen is, the better the working of the stud.

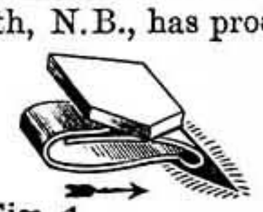


Fig. 1.

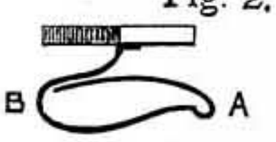


Fig. 2.

Fig. 1.—Black's Fastener. Fig. 2.—Ditto, side view.

10.—"THE ART OF GRAINING AND IMITATING WOODS."

I have received from Mr. W. G. Sutherland, the managing director of the Decorative Art Journals Company, Limited, Parts 1, 2, and 3 of a superb work entitled, "The Art of Graining and Imitating Woods." Mr. Sutherland's name is so well known in the decorative world in connection with that kind of art-work of which he is so able a master and exponent, that it is enough for me to say that anything he produces is well worthy the attention of all professional painters and decorators who desire to attain excellence in their craft, and of all amateurs who are interested in the subject, and who wish not only to try their hand themselves at the imitation of woods by brush-comb and the requisite pigments, but also to possess safe and sure guidance in the art and the means of discriminating between good and bad imitations of the original woods, both in colour and veinings. I am sorry that I am unable to state at the present moment the price of the parts of this magnificent contribution to the literature of decoration, but I can put my readers on the right track for learning this for themselves by saying that the Company's address is 15, St. Ann Street, Manchester, and that Mr. Sutherland will undoubtedly be pleased to answer any inquiries. Further, the London publisher is Mr. Henry Vickers, 12, Catherine Street, Strand, W.C., where anyone resident in the metropolis and its vicinity might see the work, if he was so minded. To give those who cannot do so some idea of it, I may say that the size of the page is 18½ in. by 13½ in., and that there are eight of these large pages in each part, and four examples of the graining of different kinds of wood, beautifully and artistically rendered in colour, and representing the work as it should look when brought to completion. A chapter is devoted to the treatment of each kind of wood, and the letterpress is enriched with characteristic initial letters and tail-pieces, and in some cases with illustrations of the appliances used, of the modes by which some of the desired effects must be produced, and of examples of veining in black and white when it is helpful to show the peculiarities of the natural wood otherwise than by colour. To give some idea of the method of treatment adopted for the text, I will take Chapter VIII., on bastard mahogany or baywood—the kind of mahogany that is brought from Honduras, in Central America. In this we have first some mention of the history of the wood, especially as regards its use in this country and its rise and declension in popular favour. Then we are told in separate sections, each under its own heading, the "colours required;" the "grounding," how it is to be made; and "how to grain it," describing clearly the manipulation that is necessary. We are then introduced to "another method" of arriving at a similar result by "flogging in the ground," "pencilling," and "glazing." The value of the directions is further enhanced by side-notes in small type, which enable readers or those who use the book as a work of reference to gather the nature of the text without wading through it from beginning to end, by merely running the eye down the side of the column until the position of the information required has been found and noted.

11.—"PHOTOGRAPHY IN A NUTSHELL."

Not long ago I called attention to a manual of photography entitled "Photography in a Nutshell," which was sent by the publishers, Messrs. Iliffe & Son, 3, St. Bride Street, London, E.C. It was in a paper wrapper, and its price was 1s. I have now received another copy from Mr. William Tylar, 57, High Street, Aston, Birmingham, which I am bound to notice on account of its marked peculiarity in having every right-hand page blank for notes. Mr. Tylar says: "I have much pleasure in sending for review *my* latest edition of 'Photography in a Nutshell.' I am sure that practical workers will welcome the combination of a practical book of reference with a note-book, especially as the interleaf is so arranged that the printed index refers to the written notes as well as to the corresponding printed paragraphs. It is an entirely new departure in photo literature." That it indeed is, and a departure that might be adopted with advantage in other books—especially books for use in schools and colleges. The new edition is bound in cloth, and its price is 2s. 6d. Whether or not Mr. Tylar is the "Kernel," the *nom de plume* of the writer of the volume, is a matter for speculation into which I do not attempt to enter, but with this, the entire absence of title page from the copy in my hands—another new departure in literature generally—has probably something to do.

THE EDITOR.

SHOP:

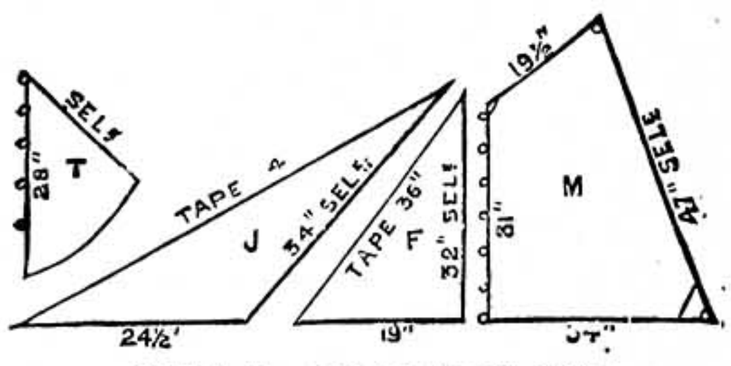
A Corner for Those who Want to Talk It.

*** *In consequence of the great pressure upon the "Shop" columns of* Work, *contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of Work *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—Letters from Correspondents.

Self-Acting Model Yacht.—T. H. C. writes:—"I enclose particulars of a self-acting model yacht I have made. She is 40 in. overall—*i.e.*, from stem to stern—13 in. wide, and 8 in. deep, with a false wooden keel 1 in. wide by ⅝ in. at stern, tapering down to ½ in. by ¼ in. at prow, and below this is a



Self-Acting Model Yacht Sails.

leaden keel of 22 lbs. weight, ¾ in. by ⅝ in., tapering down to 1⅞ in. by ¼ in. at prow. Spars—Mainmast, above deck, 37½ in.; topmast, outside the head of mainmast, 26½ in.; boom, 37 in.; gaff, 23¼ in.; jibboom, 25¼ in.; fore staysail boom, 20 in.; bowsprit, outside stem head, 35½ in."

Rate for Circular Saws.—A Wood-Worker writes:—"*Do we drive our circular saws too fast?* This is the gist of a question put by F. A. M. on page 12, Vol. III. I am aware of the fact that machine saws driven by steam are driven very fast indeed, the limit being in the stability of the machinery—that is, its smoothness of running and absence of vibration. It is this last desirable quality that prompts makers to adopt the box pattern now so general, in preference to the older plan of several frames bolted together. But it may be that such velocity is not absolutely necessary, except as an essential to rapid sawing. Could we then saw at half the pace with a saw velocity reduced in proportion, and the motive power equally diminished? I believe we could. But it would be necessary to abolish *slip*, which is the bane of belt-driven machinery. We are between two difficulties—a slack belt means slip, and a tight belt means waste of power, while all the applications of resin, etc., which may prevent slip, involve the loss of some power by the parting of belt and pulley, which is as inevitable as the movement. What is to be done, then, to secure the desired result at the least cost? Gearing is noisy, and not to be thought of; but it may be that we can learn a lesson from the cyclist. We know that if his rear-driving safety was connected with pedal by means of a very tight belt, he could not perform the great distances at the great speeds now so often accomplished. And if it were known to me how to alter a treadle machine in my possession, which now drives the saw by a leather belt, into a machine which drives with a chain, which need not be tight, but fits each wheel, I would experiment, and make the result known in Work. For some time past there has been an advertisement of a hand circular saw in Work (which was in the late Exhibition), and I believe it works well, although the saw revolves but slowly; the feed is in proper proportion, and there is no slip. Probably the teeth of the saw might need adapting to the speed, making the angle of clearance less, and making the tooth more a cutting tool and less a scraper; but if the space between the teeth is sufficient to contain the waste of the stoutest stuff it is used to cut, I think such a modification could but be of benefit."

II.—Questions Answered by Editor and Staff.

American Organ Coupler.—Coupler.—The sketches given on page 633, No. 91, are correct, and do not require reversing as you suggest. Fig. 1 shows the bass coupler, which acts on the octave below the note touched; and Fig. 2 is the treble coupler, which acts on the octave above. The "A" end of the wires is pressed down by the button on the forepart of the key, and the "B" end presses on the collar or button on the plunger of the key an octave above or below, as the case may be. You ought to have no difficulty in arranging the wires and bending the flattened ends so that they will work without catching against each other, as the amount of movement is very slight. The platform need not be as much as 2 in. wide, and the wires need only overhang sufficiently to work. But the sizes of the various parts depend entirely on the amount of space available, and are not arbitrary. You appear from your sketch to have room for the coupler described without shifting the register or lath through which the plungers pass. As regards the broken screw in the reed plate, you may perhaps be able to move it by applying the edge of a small cold chisel to the head of the screw and gently tapping it with a hammer so as to cause the screw to be gradually moved round. After two or three turns, you would be able to get hold of it with the pliers and screw it out easily. If you cannot manage this, you might drill the screw out, but the first method is preferable. A hot wire held on the top of the screw and a drop of oil placed on it will facilitate the turning of the screw.—M. W.

Coach-Painter's Outfit.—Apprentice.—You want to know "where to get good pencils and varnish brushes," etc. There should be no difficulty in a town like Leicester to get all that you require. I purposely avoid saying, "Go to a good shop and pay a fair price"—advice often given in journals to inquirers. At the outset, the inquiry is for a good shop and about a fair price. Such a reply assumes that the querist will know a good shop when he sees it, and what is a fair price when the price is stated. A few questions to an old workman about paint-brushes and pencils will win you more information than any stranger's answer will help you to. But, in utilising your question for the benefit of others as well as yourself, it suggests a few remarks. It is nearly everywhere the rule for employers to find varnish brushes for workmen. All they are expected to find are the pencils for fine lines, stripes, or bands, a putty-knife, a stopping-knife, and a chisel-knife. The pencils are camel-hair, sable (red and brown), and ox-hair from the ear of the ox—nearly white hair—for some purposes. The ox-hair and camel-hair are mixed in pencils for striping. Coach-painters' pencils are known as "liners," as they are used for the lines on carriages, the hair being from 2 in. to 2½ in. long. The terms for sizes are by the quills in which they are held, the band pencils being in goose-quills, stripe pencils in duck and crow-quills, and fine-line pencils in lark-quills. The short-haired pencils are known as the same, with the addition of the swan's-quill, for spot-work or carriage gear painting. These last an employer finds for his men. The prices of the "liners" are from 3d. to 1s. 10d. each. To try their quality, there is nothing better than drawing from the wet tongue over the lips, so as to saturate them with wet, and then spread them flat on a piece of glass with the fingers. They should feel free of knots, and, when flat, should be parallel-edged and square-pointed. In use they are not square-pointed by finely tapering; the flatting out on the glass makes them square-ended, where the separate hairs may be counted, so fine is the spread of the hairs under the fingers of the fine-liners. It is said of steel watch-springs, that they are dearer by weight than gold. These fine hairs of the Russian ox, sable, or camel are dearer than either by weight when mounted as pencils, and it may not be amiss to remark that gold intrinsically is a worthless metal compared to many others, or with such humble materials as hair, drugs, etc. Having bought your pencils—dearer than gold, some of them—you have to handle them with wood to suit the size of the quills. Soft cedar is a good wood for the purpose, as it is soft enough not to burst the quill when pressing it in. Be sure to file the part you pocket into the quill with a fine file; by holding the quill part in the mouth, or putting in warm water, it saves from splitting the quill; a little varnish on the dry point of the handle and in the quill cements them together. The putty and other knives are from 9d. to 1s. 6d. each. Just a word about taking care of pencils: you must not leave them in the paint-dipper for the paint to dry on the hairs; some paints are like glue, some corrosive. Wash them out with turpentine, wipe them dry, and draw the hair between the fingers as they hold a clean piece of hard tallow; spread the hair out flat and straight with tallow, enough just to make them stick to a bit of clean panel or glass, and put them thus into a small box or tray-draw. This tallow is easily washed off before using again. A good plan to compare prices is to get a price list from two or three makers. They will not vary much: the most intelligently written and illustrated one will doubtless commend itself to you. J. B. Smith, 117, Hampstead Road, London, N.W., issues a 42-page catalogue, fully illustrated, as do many other firms whose names I forget.—J. C. K.

Book Sewing.—One in Trouble.—Read the articles upon "Bookbinding" in Vol. II. of Work, where all instructions are given for sewing books. If you follow the details there given, you may be able to sew your volume.—G. C.

Phonograph.—The article on the above, with working drawings, will be published when space can be spared for it. I hope you will find them answer your purpose, and that you will be able to make the instrument.—W. D.

Telephone.—R. A. D. (*Forest Hill*).—From the meagre description you give it is impossible to tell what is the matter with your telephones. Your magnets may not be strong enough, or too near to, or too far away from, the diaphragm. Or the diaphragm itself may not be tightly clamped. You want a transmitter and battery to get good speaking results.—W. D.

Enlarging Photographs.—Nil Desperandum does not say if the photographs are paper prints or transparencies; in any case there is no necessity to injure them. If on paper, they must be fixed on a flat surface in a good light, avoiding reflections, and a negative made of them in the usual manner. If on glass—that is, glass transparencies—they must be placed so that a strong light is reflected *through them*. A large sheet of white cardboard is the best reflector, set at an angle of 45° behind the transparency—all other light except that passing through the transparency carefully shielded from the lens. A negative is now taken in the ordinary manner.—D.

Whole-Plate Camera.—H. B. (*Hammersmith*).—If you refer to the first volume of Work, you will find full instructions for making a whole-plate camera. The size you want is for plates, 6½ in. by 4¾ in. You can easily reduce that given to suit this measurement; you may make it somewhat lighter all through. If you can grasp the principle of the thing, you will have little difficulty. To give drawings, measurements, and text, would occupy too much space in these columns. You can get the metal and other fittings of Parks, 1, Orchard Buildings, Kingsland Road, N., and the lenses of any photographic material dealer; there are scores in London. The kind of lens depends very much on the kind of work required. The best kind of lens for general work would be either of the rapid rectilinear or symmetrical type. The portrait form is not suitable for anything else but portraiture, the field being too round. The size of the stand is very much a matter of taste—about 5 foot is an average height. You will find diagrams and descriptions of this also on referring to the back numbers of Work.—D.

Roller Model.—J. G. (*Aberdeen*).—The necessity for rollers or castors under heavy drawers is by no means so great as you seem to suppose, and to have them under drawers no larger than those in an ordinary dressing chest would be quite superfluous. As a matter of fact, your idea is by no means a new one, for I have known of similar contrivances being used for many years whenever required. The ordinary sash roller is far better for the purpose than the model you send, which, from a practical tradesman's point of view, is defective in many respects for general purposes. You will thus see that I cannot hold out any hope of your making a success with the article if you were to incur the expense of patenting it. In case you wish to try what chance you have with your roller in the open market, submit your idea to any of the Birmingham cabinet brass founders.—D. A.

Water in Gas-Pipes.—S. M. (*Kidderminster*).—From the fact that where dry gas meters are used there is seldom, if any, trouble about water in the pipes, I conclude that it is caused by a certain amount of water being brought into the pipes from the water that is used in a wet meter. Put a syphon in the lowest part of your pipes with a small tap, which, if turned off now and then, will remedy the defect.—R. A.

Incubator.—Chicks.—An article on "How to Make an Incubator" appeared in No. 89 of Work.

Home-Made Furniture.—S. C. (*Ashton-under-Lyne*).—You may send photographs of any of your home-made articles, together with descriptions of how you made the same. If suitable, publicity shall be given them.

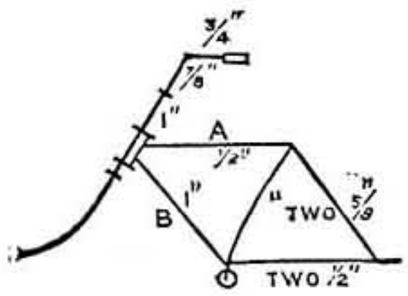
Japanning Oven.—E. H. (*King's Cross*).—The temperature of your oven should range from 260° to 300°. It is advisable to stove the ground colour first, and then put on the decoration, and stove again at a little less heat. For paints, japans, and medium for applying gold-leaf or bronze-powder, apply to Mander Brothers, Varnish Manufacturers, Wolverhampton; or to Wilkinson, Heywood, and Clark, Caledonian Road, N. Works: West Drayton, Middlesex. Either of these firms will supply your needs.—R. A.

Ice-Cream Freezer.—J. C. (*Belfast*).—It is a very simple affair, and consists, as you are perhaps aware, of a pewter cylinder with a bottom, and with a well-fitting cover. You do not state what size you require it to be, and not knowing your trade or what tools you have, it is rather a difficult matter to advise you upon; but, however, here goes. To make one 15 in. deep and 6 in. diameter, get a piece of pewter ⅛ in. thick (or a shade less will do), 18¾ in. by 15 in. If you can get a tinsmith to turn it round for you in his rollers, it will save you a lot of trouble; if this is out of your power, you can bend it round on a piece of iron pipe, 4 in. or 5 in. in diameter, or on a round piece of wood. Let the edges "butt" together—not "lap" them—and solder down the seam with a hatchet, soldering-iron, or a blow-pipe. Cut a circular piece, and solder in one end for the bottom; file off all superfluous solder, and scrape smooth. For the lid, cut out a rim 2 in. in depth, and long enough to go round the outside of the vessel just described; solder as before, and solder a similar circular piece to the one in the bottom; if you can hollow it up, it will look all the better. Then bend a piece of tin or lead pipe to form a handle, and solder it on to the lid, and the affair is completed. Finish up with glass-paper and a burnisher if you want it to look anything.—R. A.

Telegraph Wires.—Ned.—Lay the line wire in the groove of the insulator on one side. Pass one end of the binding wire over the line wire to the left of the insulator; form this part of the binding wire into a loop, and hold this in the left hand. Then pass the other end of the binding wire over the line wire to the right of the insulator, draw it tight, and then bring the line into the insulator groove on one side, whilst the binding wire is pulled tight into the groove on the opposite side. Pass the right-hand end over the line to the left,

and the left-hand end over the line to the right; pull both well into the groove, then twist the two ends together with a pair of stout pliers, and cut off the surplus ends. Each wire end in the $\frac{7}{14}$ cable must be separated and cleaned with emery cloth to the length of 2 in.; these cleaned ends must be spliced or twisted together, moistened with soldering fluid, and soldered in the ordinary way. Wipe clean with a rag, and bind the joint with tarred tape. After this is done, restore the outside insulating and protecting covering.—G. E. B.

Light Roadster Bicycle.—A WELL-WISHER OF "WORK."—The weight of tubing for a light roadster or racing machine would be all over 15 in. B.W.G., the thickest tubes would be 1 in., and smallest $\frac{1}{2}$ in. The spoke wire, if for direct spokes, would be No. 10, 11, or 12; if for laced or tangent wheels, No. 15 is heavy enough. Handle bar may be bent by heating to a bright red the part you wish to bend; grip the straight part in a vice—that is, the end part where the handle will be placed—and use the remainder for a lever; it will thus be readily bent. If the bend is somewhat quick, the part bent will incline to oval: this may be cured by hammering carefully on a smooth anvil. The only other bent tube is the seat tube, and it may be bent in the same way. See that as much of the tube as you wish to bend is heated at once, and equally. The sketch given above has marked on it the thickness of the various tubes composing the frame. Some diamond frames—such as the "Referee" and "Swift"—have the tubes A and B both $\frac{3}{8}$ in.; so it is a matter of choice. For an ordinary heavy roadster all the tubes would be $\frac{1}{16}$ in. heavier than indicated in the diagram.—A. S. P.



Bicycle Frame.

Amateur Printing.—ELEVEN.—Information as to the cost of requisites for this work may be had from the Model Printing Press Co., 3, Ludgate Circus Buildings, London, E.C.; or from the Birmingham Machinists' Co., Parade Iron Works, Birmingham. As he is something of an amateur workman, ELEVEN thinks that if he knew how to set about it, he might make a press for himself. I think so too, and will, if he wishes it, help him to full directions for constructing a small press.—S. W.

Home-Made Camera.—W. J. U. (*Leytonstone*).—An article on the above appeared in WORK, No. 70. It will probably suit you.

Oilstone.—RISHTON.—You would be able to procure the stone you require from Mr. R. Hickman, Worcester Street, Wolverhampton. I do not know of any book on the subject of cutlery.—T. W.

Hinge and Catch.—J. E. W. (*Camberwell*).—I have seen such spring hinges and catches as you refer to, but they are by no means common, and at the time of receipt of your letter I was unable to say where they could be obtained. However, as the result of inquiries among the cabinet brass-founders in Birmingham. I find that Messrs. R. Gardner & Co., 66, Granville Street, Birmingham, can supply you with them.—D. A.

Medical Coil.—A. B. (*Accrington*).—A series of articles on "Coils" is now in course of preparation. In these a medical coil will be fully described and illustrated.—G. E. B.

Pipe Mounts and Ferrules.—J. D. (*Dundee*).—To make an ordinary pipe mount, a plate of silver has to be prepared exactly the size, or perhaps a shade smaller than will fit tight round the two pieces that are to be joined by its means. The easiest way to obtain a pattern of suitable size and shape for this plate is by wrapping a piece of smooth paper round the place where the mount is to go, and very carefully cutting all the surplus away with a pair of scissors until one thickness of the paper is all round the pipe. If this is well done, due attention being paid to the straightness of the soldering seam and of the ends, then the silver can be cut to it exactly. The next thing to do is to get the plate flat, and then proceed to turn it up into a tube quite free from bruises or kinks. For this a "triblet" is required. It is nothing but a piece of smooth, round, tapering piece of iron or steel and a bending block, such as is figured in No. 41, page 618, Vol. I. of WORK. A mallet also may be necessary if the silver is thick; if it is not, then it will come up by the pressure of the hand almost; or, in place of block and mallet, a pair of half-round pliers will do if the silver be rather thin. For mounts of less than an inch in length, I should say size 6 Shakespear gauge would be plenty stout enough. The next step is to fit the soldering seam so that the two edges are quite level and true with each other; see also that no burr from the file is left before tying with wire. A scraper, made from a three-square file, is usually the tool used, but a knife will do as well. Should the mount be long, it would be well to file small nicks in the edges that form the seam (as shown in Fig. 1, *a a*), for the solder then holds better, and will not be so likely to open during the later operations it has to undergo. When fitted, it has to be tied with iron binding wire in such a manner that the edges of the seam are retained in their places during the operation of soldering. Wire should not be used too thick, as in cooling it will shrink, and may bruise the work. In most cases the tying of the wire will not be difficult, but it will be so when the mount is very taper (as in Fig. 1). Here there are means taken to prevent the binding wire slipping down, which, I think, needs no further explanation than the sketch. Many of the details of soldering are given in No. 37, page 588, and No. 46, page 732, of Vol. I. of WORK, so that can be passed over here, and we can proceed with the mount after it has been soldered and "pickled," and all pieces of unflushed solder filed away. The mount is sure to be more or less out of shape now, so we have first of all to get it true and smooth; this can be done pretty well on the triblet, previously spoken of, with a smooth-faced mallet. A lathe would be useful at this and at the polishing stages, but we are to do without it. So if the triblet and mallet or hammer will not get the mount smooth (and it will not if very thin metal is in use), then it will be worth while to get made a kind of ribbed burnisher (as shown in Fig. 2). I do not know that this is made and used generally, but with it it is quite possible to rub the thinnest of collars true and smooth. The size of it would be from 7 in. to 10 in. long, and about 1 in. wide; the thickness will be $\frac{3}{16}$ in, or thereabouts. An old flat file can be made to do capitally. The ribs or ridges should be quite smooth, and the size shown in sketch will do for their average size. The sketch shows only part of this tool, for I have not the presumption to ask for space to illustrate it at its full dimensions. Somehow or other we will suppose now that the mount is in shape, and fits the pipe; therefore we have but to smooth it up and polish it. It may need filing to remove hammer marks, etc.; if so, then get them out at once with the file. Do not depend on glass-paper or emery-cloth. These two

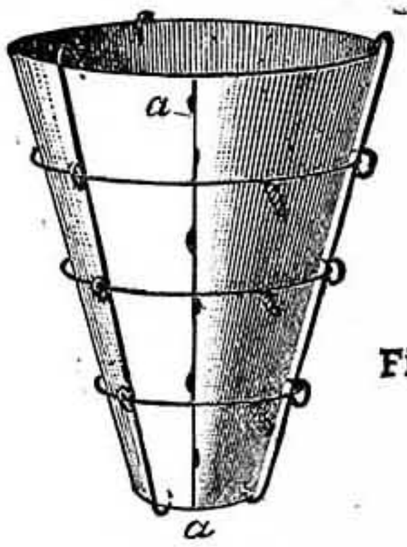


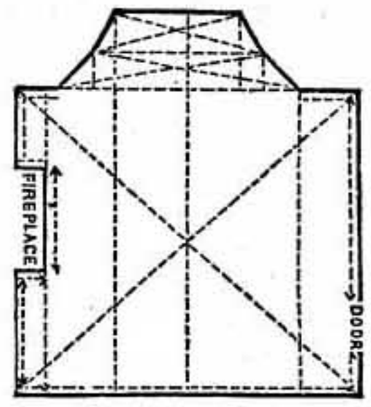
Fig. 1

Fig. 2

Pipe Mounts and Ferrules. Fig. 1.—Mount. Fig. 2.—Ribbed Burnisher.

articles are very useful in their way, but they tend to make the corners rounding when they should be sharp. Either can be used after filing, but use the smoothest quality. The next thing is to polish the mount. The theory of polishing is a simple one. It is the application by friction of abrasive materials in stages of gradually increasing fineness. If that theory is understood, it will be easy for this correspondent or anyone else to make shift with materials to hand. Those I now speak of are the proper articles, a lathe not being allowed. As the mount we are to polish may be thin, and therefore likely to get out of shape, it will be best and easiest to fit a piece of wood to it, which will serve the double purpose of supporting it and of allowing it to be handled with comfort. The first thing used is a stick of water of Ayr stone; this is used with water, a damp sponge being employed to remove the mud-like stonings as they are produced. The next polishing material is powdered pumice-stone and oil; after that, crocus and oil (or rotten-stone or Tripoli powder and oil). Any or all of these are to be applied by means of buffs charged with them. A buff is merely a strip of buff leather (soldiers' belts), glued to a piece of wood. With these and plenty of elbow grease the mount will soon become bright and smooth. Next brush it with damp whiting (not too hard a brush, please), and then wash it in hot soda and water to remove every atom of grease and other polishing material. In rouging—tools, rouge, hands, all must be clean and free from grit. Use a buff at first; then charge the palm of the hand or ball of the thumb for finishing, thus using the skin as a finer kind of buff. After washing once more to remove any rouge there may be, the mount is ready for fixing on. Each material used must be entirely removed from the work before the next finest is used, and for that reason separate buffs are to be obtained. They only cost about 3d. each; and as for the other polishing materials, the water of Ayr stone, the crocus, and rouge can be obtained in three-pennyworths or thereabouts at any jewellers' material shop. Powdered pumice and whiting can be got at any oil-shop, for they are used in the household. There are other materials used, but these are sufficient for the present jobs. With reference to ferrules for the ends of sticks, the same set of processes has to be gone through; they are, however, less carefully finished. With reference to the plate at the end, which is to stand the wear—What is to be put in? Steel, iron, or only a thick metal plate? Whatever it is, pewter solder seems good enough to hold it. These ordinary ferrules can be bought so cheap that, except for practice, nobody would make them.—H. S. G.

Carpet.—WEST KENSINGTON.—Had you stated exactly where your difficulty lies, I could no doubt have done something towards removing it, but apparently you want to be told all about carpet planning, which really cannot be done in "Shop." It may be that you want to have a definite rule to go upon in all cases, a sort of "guide to carpet planning in a nutshell," and, to accommodate you as far as possible, the best advice I can give you is to use your common sense, and not to be afraid of taking all measurements with the greatest accuracy. Something near the mark will not do. Be careful to take not only the measurements along the walls, but take them from angle to angle wherever there is an opportunity of doing so. These will materially assist you when you proceed to set out the full-sized plan of the room—in fact, you cannot do without them. When measuring, take down on a sheet of paper a rough plan of the room, and mark in position the various dimensions. The carpet itself will be best fitted and made to a full-sized plan, which you can mark out on a large floor with chalk. To give you some idea of measurements, the small diagram which accompanies this will be useful. As it is necessarily on a small scale, the measurements are not stated. You will understand that the dotted lines must be measured, and, of course, round the walls. Experience only can teach a man to know exactly what cross measurements are absolutely necessary. As a beginner, you will find it better to take too many than too few. Act on the reverse of the saying, "When in doubt leave out," by putting in all that may assist you when planning the carpet, even though you find afterwards that some of it is superfluous. If you attend to this brief advice on a very wide subject, and use your brains, you will not make any very serious mistakes.—D. D.



Carpet Measure Plan.

Potash Battery.—VOLTAGE.—It is several years since I had anything to do with the battery made up of iron turnings and black potash, but I have some remembrance of its voltage being slightly less than the Leclanché—say, about 1·2 volts. The internal resistance of the quart size, when first made up, was a trifle less than that of the No. 2 Leclanché cell. It was simply a modification of the Bennett battery, black potash being substituted for caustic potash. Its chief merit lay in its low first cost, as it could be made up out of old tin pots, iron turnings, and scrap zinc.—G. E. B.

Battery Carbons.—OBLONG.—(1) Battery carbons may be made of very finely powdered gas carbon and wood charcoal sifted free from lumps and mixed in the proportion of four parts carbon to one part of charcoal. The mixture must be made into a stiff paste with a sufficient quantity of treacle, and pressed very tight into an iron mould, which must then be tightly closed, heated to a bright red, and allowed to cool slowly. When the mould is cool, take out the carbon plate or bar, soak it well in the treacle, place again in the mould, and again heat the mould to a bright red. Repeat this treatment until the carbon has been rendered sufficiently dense and hard. (2) Before attempting to cap the plates, see that the carbon is quite dry. Let the heads stand well above the tops of the cells, and paint them whilst still hot with a sufficient quantity of Brunswick black to soak well into every crevice beneath the head and down the plate to the depth of $\frac{1}{2}$ in. below the head. If you do this well, I think you will not be troubled with corroded heads. (3) I have not had any experience with baked manganese, but should think the process doubtful as a means of restoring oxygen to the partly exhausted manganese.—G. E. B.

Water Power.—A. B. (*London*).—Three gallons of water weigh 30 lbs., therefore the gross power at your disposal is 40 ft. × 30 lbs. = 1,200 ft.-lbs. per minute. As one horse power is 33,000 ft.-lbs. per minute, your gross power is equal to about one twenty-eighth of one horse power—rather less than half a man power. A small turbine will be the best motor for you to use; a good one will utilise about 75 per cent. of the total power, and so give 900 ft.-lbs. per minute, or one-third of a man power. The Index to Vol. II. is published and can be had, price 1d.—F. C.

Solder for Albo-Silver and Aluminium Gold.—V. T. (*Galley Hill*).—This correspondent says he cannot obtain satisfactory results with spelter solder. Now, in very many cases it is the lack of scrupulous cleanliness that causes difficulty with the proper fusing of solders. Is the borax clean, the water clean, the spelter clean, and the work well scraped?

Is the flame used to solder with a clear and not a smoky one? If all of these are answered Yes, then it will be the spelter solder that is in fault; so when next either albo-silver or aluminium gold is bought, the proper solder should be asked for. I have not had occasion to work the albo-silver, but the makers of that alloy (Messrs. Reading & Co., of Warstone Lane, Birmingham) tell me that they have a special solder for it, which is sold at 4s. per lb. For both of these alloys the ordinary silver solder that can be bought at jewellers' material shops will do all right—that is, if the aluminium gold which I have worked is the same as that you have. The proportions of aluminium and copper will very probably vary with every maker, so it is quite probable that I may be wrong in your special case; hence it will be best to do as I say above—obtain the solder from the same place where the metal is bought.—H. S. G.

To Clean Silver Filigree Work.—E. B. (*London, E.*).—The only ways to restore the dead white surface to silver filigree are:—First, by having it put in the plating solution, when a fresh coat of fine silver can be deposited on the surface; or, secondly, by annealing and pickling it. This last process will hardly do with stock work, as in time the article would be destroyed through the gradual removal of the outer layers of silver, for it is by refining the surface (taking all the alloy out, that is) that the pure silver coating is obtained. The means I take to make silver presentable is as follows:—Make whiting into a paste with a solution of half water and half liquid ammonia; then, for this class of work, I cover it completely with the paste, and leave it for a quarter of an hour or so; then wash thoroughly in boiling hot water, well rinse it also in boiling water, and then, without any exposure to the air, it is next to be covered up with hot clean boxwood dust, until it is thoroughly dry, when a soft brush can be used to remove the sawdust. This diluted ammonia with whiting is a good thing to use with ordinary bright silver work, where a brush can be used to apply it. Of course, a brush is hardly suitable here, as the work must be kept as dead as possible. If the filigree is made of really fine silver, then it might be worth while to try the Indian method, as described by G. E. Gee, on page 142 of his "Silversmith's Handbook," as follows:—"Some juicy lemons are cut into slices; the silver articles are briskly rubbed with these for a short time, and subsequently covered with them, being placed in a suitable vessel for a few hours for the completion of the process. For very delicate articles of jewellery, the natives cut a large lime nearly in two halves, into which they insert the work; the halves are then tightly closed up again, and placed aside for a few hours. When the article is removed, it is well rinsed in clean water, and consigned to a vessel of nearly boiling soap-suds, where it is well brushed, again rinsed in fresh hot water, and finally dried on a metal plate placed over hot water; the process is rendered complete by a little gentle rubbing if the work be of a plain nature. Green tamarind pods are also employed by them for the purpose of whitening silver, in the same manner as just described; they are great detergents of both gold and silver manufactures, and are largely employed by artisans in the East for the removal of oxides and fire-marks." In the above quotation, the drying of the articles does not seem to be so thorough as it will be if the box sawdust is used, and is heated in a basin or other receptacle surrounded by hot water. The sort of thing best to use is something on the principle of a "Bain-marie pan," used in cooking, or else that of a glue-pot. Dry heat is too risky, for one can say good-bye to nice white work, if ever so small a portion of the boxdust gets burned. If the Indian method is tried, all metal tongues or joint pins will have to be taken out.—H. S. G.

Geneva Watch.—AMATEUR.—It is impossible to help you, as you give no particulars. Take it back to the watchmaker who did it, and do not pay for doing it till it goes.—A. B. C.

Current from Battery.—A. M. (*Rochdale*).—If you have not a galvanometer to detect the current, you may still tell whether current is passing or not by the following simple device:—Connect two wires to the battery, one to each pole; clean the two free ends, and place them on your tongue; then bring the ends together on the tongue. If current is being given off from the battery, a sharp acid flavour will be tasted at the moment of crossing the wires, and this flavour will be sharper when the current is vigorous than when it is sluggish. You cannot feel the current in your hands. After mixing the acid with water, allow it to cool before placing it in the cells, then it will not "burn away the zinc." Of course you know that the zinc must be coated with mercury before using it in a chromic acid battery. I do not know the depolarising liquid used by Dr. Gassner. Try soaking in Condy's fluid disinfectant. The copper wire is soldered to the top of the zinc cylinder. It is merely in place of a binding screw, but I prefer the screw.—G. E. B.

Clock Designs.—AN APPRENTICE MASON.—If you wait patiently, some designs for clock cases will be given. Freestone is scarcely to be recommended as a material for clock cases.

Wire for Electric Bell.—A. P. S. (*Heaton Chapel*).—The two bobbins 2 in. by ¾ in. will take about 92 yds., or about 9 ozs. of No. 24 silk-covered copper wire, and this will cost somewhere between 1s. 3d. and 1s. 6d. A papier-mâché tube will do very well for the body of the bobbins when fitted with hard wood collars for the ends. Be sure to glue these on firmly, or the wire will push them off. Also have the tubes thin, so as to get the wire coils as closely as possible to the cores.—G. E. B.

Sanitary Rail.—MEDICUS.—A simple and effectual method of admitting fresh air into ordinary dwelling-rooms is shown in Fig. 1. It consists of a piece of wood fitted tightly in between the sash beads on top of the inside of window-sill, and secured by small dowels at bottom and two blind bolts on top, so that it can be removed for the purpose of cleaning windows, and that on raising the bottom sash 2 in. or 3 in., a current of fresh air is admitted between the meeting bars in the direction shown by arrows. The meeting bars of an ordinary

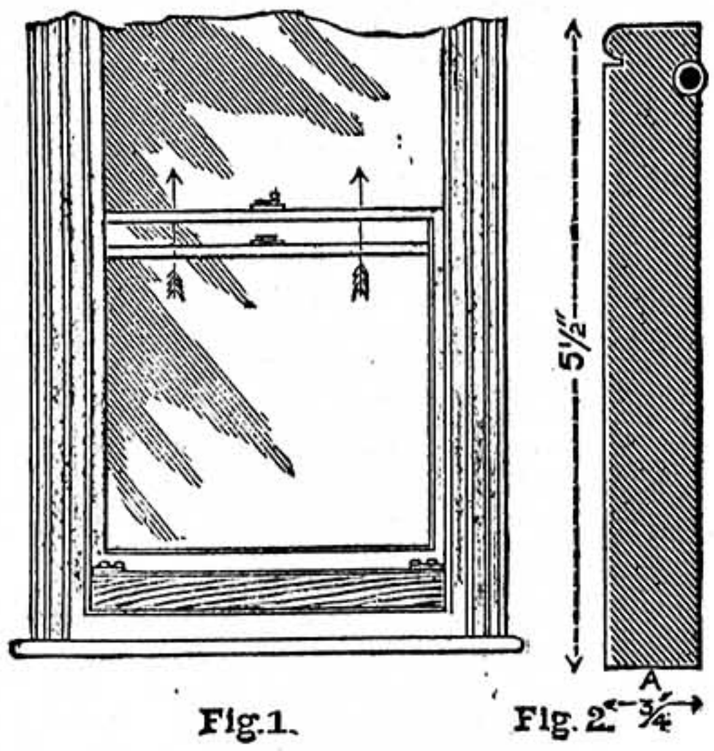
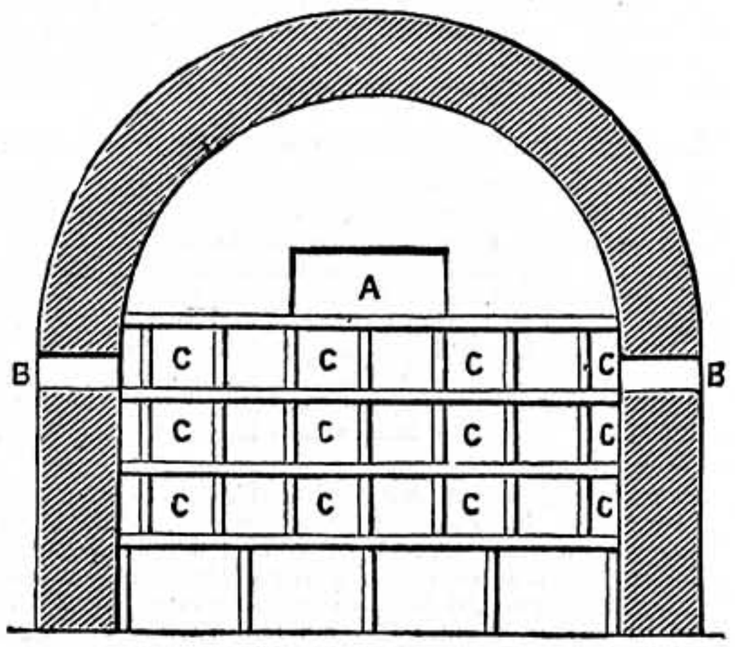


Fig. 1. Fig. 2.

Sanitary Rail.

hung sash being above 6 ft. high from the floor, and the current of air directed upwards, persons in the room feel no inconvenience. Fig. 2 shows the end view of rail with a piece of indiarubber piping inserted and glued in a hollow groove, against which the face of the bottom rail of bottom sash slides, and thus prevents a draught at this point. I generally put a similar piece of piping along the bottom of rail to make a good joint down on the bead at A. The ventilation of a room would be very much more complete with the addition of an outlet ventilator into the chimney, or any other convenient point as near the ceiling as possible, to ensure a thorough change of air by continuous circulation.—E. D.

Kiln.—ANTONIO.—The simplest method of building a kiln is to form a square or oblong chamber, arched at the top; it should be lined with fire-bricks set in fire-clay, and backed up outside, or hooped with iron, to prevent it giving way from the heat. At one end a furnace with grate bars is formed, and having a vent over the door for the admission of air, with a sliding fire-brick lump to regulate it. Inside the chamber a number of spaces are formed



Section of Kiln—A, Flue; B, B, Sight-Holes.

of fire-brick, and covered with fire-brick lumps set in fire-clay. The figures are placed in each alternate space, and the flame and heated air from the furnace are arranged to pass through between each space occupied by the articles to be fired. The sketch above is a section of the chamber, the spaces marked C,C,C, containing the articles; and the flame passing through the remaining spaces, and escaping at A into the chimney. The chimney should be 20 ft. or more in height, so as to have a good draught. The fire is put away slowly at first, till the kiln is heated throughout; it is then urged to the requisite heat for burning the articles, which is tested by having pieces of clay put in at the sight-holes, B, B, at each side: these are examined from time to time till of the required degree of hardness. The sight-holes are covered by fire-brick lumps, and the draught is regulated by admitting more or less air over the furnace door. As soon as the articles are sufficiently burnt, all the openings are closed up, and the kiln allowed to cool gradually. If you only have a few articles to burn, you will find it more economical to send them to some works to be burnt than to do it yourself.—M.

Lacquering.—A. B. (*London, N.E.*).—Lacquering can scarcely be called a "trade by itself." I should think it might be more correctly called a branch of the brass-finishing trade, though there is this to be said about it: that in large establishments there are persons employed solely in lacquering. I am not aware of any classes for practising lacquering, nor of any books bearing specially on the subject. There is some information on the subject in Spon's "Workshop Receipts" (First Series), which would be of use to you. With regard to the latter portion of your letter, where you ask, "Has one a chance of a job who has had some practice at filing and finishing and lacquering" brass?—to this I can answer, Yes; such persons are frequently advertised for in the *Daily Chronicle* and other papers. My advice to you is to get into a good shop as improver, at whatever salary you can get, and make the best use of your eyes and ears. You would then, if diligent, soon be capable of taking a better job.—R. A.

Microscope: Where to Buy It.—W. W. (*Wensley*).—See reply to B. G. F. (*Bristol*), and for trade catalogues, with prices of microscopes of every description, write to either of the following firms for catalogues:—Mr. E. G. Wood, 74, Cheapside, E.C.; Messrs. Watson & Sons, 313, High Holborn, W.C.; Mr. J. H. Steward, 406, Strand, W.C.; Mr. J. Browning, 63, Strand, W.C.; or Messrs. Sands & Hunter, 20, Cranbourne Street, W.C. If you only require a very cheap microscope, I may tell you that Messrs. Lancaster & Son, Colmore Row, Birmingham, used to make up a cheap botanical microscope—one power, 1s.; two powers, 2s. 3d.; three powers, 3s. 6d.; table microscopes, mounted on three feet, from 2s. 6d. The same firm used to supply amateurs with a set of lenses for making a compound microscope with a power of 200 diameters, and a lithograph and instructions, 3s. 6d.; or the same with a power of 400 diameters, 5s. 6d., and power of 600, 7s. 6d. Set of achromatic lenses as above, with a power of 200 to 400, 10s. 6d.; or power of 600, 21s.—C. A. P.

Books on the Microscope.—B. G. F. (*Bristol*).—A cheap manual dealing with the microscope is published by Mr. E. G. Wood, 74, Cheapside, E.C., under the title of "The Microscope: How Made and How Used," price 6d., post free, with a trade catalogue. If you require a more advanced work, you should get "Lancaster's Half-Hours with the Microscope," 2s. 6d.; "How to Choose a Microscope," by a Demonstrator, 1s.; "Objects for the Microscope," Lane Clarke, 3s. 6d.; "Handbook of the Microscope," Griffiths, 7s. 6d.; "Practical Microscopy," G. R. Davis, 7s. 6d.; "Hogg on the Microscope," 7s. 6d.; "Carpenter on the Microscope," 15s.; "How to Work the Microscope," Beale, 21s.; "Tuckett on the Microscope," 22s. If you want a trade catalogue, see above reply to W. W. (*Wensley*).—C. A. P.

Filling Lamps.—S. B. (*Upper Holloway*).—We have examined and considered sketch and description sent, and are of opinion that it is ingenious, practical, and likely to be useful if properly put on the market, but we cannot see our way to introduce it to the notice of anyone likely to join the inventor, as he would have to trust entirely to the *bonâ fides* and honesty of those treated with, who, when they know as much as the inventor, are too apt to think they can do without him, and in far too many cases take an unfair advantage of the information they have obtained. The only safe course we could advise would be to make a careful search at the Patents Office to see if there is anything of the kind recorded, and if not, then to lodge the provisional specimen, and so soon as it is accepted, he will then be perfectly safe in treating with anyone who may be disposed to join. We should hesitate to incur the responsibility of advising any person to treat for capital for an unprotected invention with anyone he does not know, and know well.—C. E.

Electro-Motor.—MAC.—As you have Mr. Bottone's book on "Electro-Motors: How Made and How Used," I need only direct you to its pages. On pages 29 and 32 you will find illustrations of a compact form of motor. The "Simplex" motor, shown on page 59, is also a compact form. If you wish to know how to make a small motor to run with current from one chromic acid cell, consult section 34 of the book, on pages 60 to 63. You will get very poor results, however, from a motor worked with currents from only one pint chromic acid cell. The zinc in a cell for driving a motor should have a surface area of not less than 16 sq. in., and three such cells should be provided. The poor results complained of are, I fear, due more to the workmanship than the design. I have described and illustrated in WORK a very neat and compact form of motor introduced by Mr. H. Atkinson, 137, Stamford Road, Handsworth, Birmingham, who will supply the castings for 3s. 6d. Perhaps this may suit you, but it will not do any useful work—or, in fact, any work at all—with only one pint chromic acid cell.—G. E. B.

Pocket Battery.—J. K. (*Bury*).—When lead plates are used in making a pocket battery, the cells are charged with a mixture of sulphuric acid and water. There are pocket batteries that are not charged with liquid, such as the silver chloride and mercury chloride series of batteries, in which the negative element of silver, platinum, or carbon, and the positive element of zinc, is coated with a paste of the exciting salt. The Gassner is also a dry battery. Some of these are regenerative, and therefore may be classed among secondary batteries, but they are not furnished with lead plates. You will find an account of a pocket battery in the eighth of the series of papers on "Model Electric Lights"

published on pages 790 to 792, Vol. II. of WORK.—G. E. B.

Fishing Rods.—J. N. B. (*Liverpool*).—If you will look on page 802. No. 102, Vol. II. of WORK, you will see that the subject has already had attention.—D. D.

Sideboard.—E. A. P. (*Beckenham*).—For the purpose of selling the job, you might estimate the cost of material and the value of the time. Even though you have not kept an account of this, you have probably some idea, and it will be much fairer to base your charge on this than on an idea of the value from anyone who has not seen the job. If you and your customer cannot agree as to value, get a valuer to assess it.—D. D.

Polish.—J. T. (*Merthyr Tydfil*).—The simplest and best way of making French polish is, as has been several times stated in these columns, by simply dissolving shellac in methylated spirit in the proportion of about 6 oz. or 8 oz. to the pint. The cause of your dissatisfaction with the result of the polish you are at present using probably arises not so much from the resin it contains as from want of skill in applying it. The resin should not prevent a good gloss being obtained; and I take it that this is where your difficulty lies. You may use a filling if you like, but you will find it a very difficult and tedious matter to clean it out from corners. On this account fretwork is seldom filled by polishers. If you have not already fretted the wood, polish in the usual way as far as bodying in before cutting, and afterwards finish by spiriting off. If you do not care to take the trouble of polishing, go over the work with spirit varnish.—D. D.

Improving One's Position.—H. B. (*Dudley*).—Have your past services been of such a character to your employers that they may be induced to remove you into the main works as a reward for past services faithfully and intelligently rendered? If so, they may entertain a request from you, although it would best suit them to allow you to remain where you are. Could you do better by obtaining work in a small country wheelwright's shop, where you may gain a more general insight into a greater variety of work? I do not recommend you to try model making; but if you have made any articles worth showing them, it may help you by calling your employers' attention to them. There are other roads open to you. I have a young fellow near me who has been doing the rough woodwork in a brickfield for years, but has also learnt himself wood carving at home. Another one especially, who, until he was twenty-eight years old, worked as striker at a forge, and at forty was in charge of one of the best and most complicated machines in a large engineering shop: he, like all the others, was steady, clever, obliging, and would never be beaten.—WORKER BEE.

How to Clean Brain Coral.—W. A. P. (*Hackney*).—For a piece of rough coral with very delicate portions like this, the easiest way to clean it will be by using an acid, and dissolving away the present dirty surface—that is, if merely washing in hot water will not obtain the desired result. Either nitric, sulphuric, or hydrochloric acid (spirits of salts) can be used; but as I know the last is best, I advise using that. It does well with ordinary branch coral in the proportion of $\frac{1}{15}$ to $\frac{1}{20}$ acid to water. A minute or so of immersion should be sufficient to remove the very small depth of outside surface that is necessary. Unfortunately, I have no specimen of this coral by me to experiment with, but I should proceed as follows:—Make the mixture as given above, and dip an unimportant lower part or end, and see what the result is. Whether trying the whole piece or only a portion, be sure to have plenty of warm water ready for rinsing the whole piece, and so stop the action of the acid. It is easy to see if the acid in the water is present in sufficient quantity, for if it acts it shows that it is acting by giving off a stream of bubbles. The stronger the acid, the greater rapidity the bubbles are given off. In order not to complicate matters, see that there is no grease on the piece of coral. Washing in hot water will get rid of grease, particularly if a little soda be mixed with it. It must be well rinsed in hot water, with no soda, and shaken nearly dry before placing in the acid bath.—H. S. G.

Tools and Machines.—W. T. R. (*St. John's, Newfoundland*).—Section I. of "Shop" is specially designed for the expression of ideas interesting to readers of WORK. If, therefore, you have any tools or machines of novel character likely to be interesting to workers, by all means send us on sketches of them, with particulars of what they will do. All other readers are invited to note this.

Rabbit Skins.—W. B. W. (*Wolverhampton*).—Whatever you have to say to E. H. H. upon this subject you should say through the pages of "Shop," for the benefit of all readers.

Wax-Polishing.—BEACON.—If, as you say, you have tried wax-polishing and cannot do it, I am afraid you must give up all hope of ever being able to polish anything by any method, for it is the simplest there is. I am inclined to think you have omitted to use elbow grease with the wax and turpentine. As you say you cannot find anything about wax-polishing in WORK, let me refer you to page 826, No. 52, Vol. I., where you will find the subject has been fully treated by Mr. Denning.—D. A.

Incubator.—JAMES.—It is clear that your lamp-flame is insufficient. Try a circular burner: the kind known as "Kosmos" is the best, and is obtainable at any dealer's. Should you find the chimney too long for the case you have already made, you can easily shorten it by filing a "nick" all round at the required length, and then gently knock it off. It will not materially affect the burning of the lamp.—C. M. W.

Bell Fittings.—ANXIOUS H. F.—If you send four stamps to Messrs. Baughan & Co., Charlbury, Oxford, they will send you an illustrated list of electric bells and fittings, which also contains a short description of how to fix them. Perhaps you could obtain a list of cranks, etc., from an ironmonger in Sheffield. I do not know of any list out of the trade.—T. W.

Fret Machine.—SAWYER.—The "Companion" lathe and fret saw is a good one so far as value for money is concerned, but you must understand that from its small size its turning powers are limited. If you only want to turn small articles, it may suit your purpose. The fret-sawing attachment is useful, and is a good arrangement of its class of machine—viz., that with movable arms. If you contemplate doing anything but small work, I should recommend you to lay out a little more money than the figure you name, and buy a really good fret machine and lathe separately, as the ordinary combined lathes and saws are naturally only suitable for small light things. The fret machine I recommend to you is the Britannia Company's "Improved No. 8," and you could have a lathe attachment to it, though it is not usually sold with it. I am told that the Britannia Company are devising a special lathe attachment for the No. 8, so by the time you see this answer to your inquiry they may be able to give you all particulars if you write to them direct. Their endeavour is to supply a serviceable attachment for somewhere about a sovereign. Their fret machine having a heavy wheel, naturally there will be a proportionate increase in power for turning. If you prefer the "Companion" style of machine, I think you will find the "Goodell" worth the extra amount charged for it. It is in all essential features the same as the others. The cutting of wood you send is too small to tell the kind of timber, but it seems to be sycamore, though, as your local dealer did not know, it may possibly be some other kind. Perhaps the colour misled him. Any way, it is simply a piece of white or light-coloured wood dyed grey, and can easily be got from fancy wood dealers and fret supply stores. Ask for grey wood or silver wood. Yes, it can be French polished.—D. A.

Bicycle Enamel.—J. P. (*Bethnal Green*).—You should rub down the parts of bicycle to be painted with emery-cloth or glass-paper, then wipe clean with a cloth; then procure Club hard drying black enamel, and apply it evenly with a flat brush about ¾ in. broad; cover as much as possible with each brushful, as it dries quickly, and, if possible, do not go over the same part twice. The enamel may be had in most cycle warehouses; bottle and brush, 1s. If you mean stone enamelling, you had better give it up, as the apparatus would cost you about £10, not to speak of considerable experience.—A. S. P.

III.—QUESTION SUBMITTED TO CORRESPONDENTS.

Hoop Rollers.—A. L. (*London, W.C.*) would be obliged if some reader would give sketches and instructions to make rollers (about 12 in. long) suitable for bending hoops of tin or thin plate iron.

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Violin Making.—NO NAME (*Manchester*) writes, in reply to J. E. (*Chatham*) (see page 814, Vol. II.):—"For the *wood* required, get the best well-seasoned log pine and sycamore from any respectable dealer. All the *tools* required may be procured of George Buck, 242, Tottenham Court Road, London, W. For the *varnish*, he will get a good violin varnish by applying to James Whitelaw, chemist, 496, St. George's Road, Glasgow. Follow religiously the articles on 'How to Make a Violin,' which began in WORK, No. 105."

Browning Gun Barrels.—P. J. R. B. writes, in reply to C. B. F. (see page 734, Vol. II.):—"Try the following: Wet a rag with antimony chloride, dip it in olive-oil, and rub the barrel with it. In about forty-eight hours it will be covered with a kind of rust. Brush it with a scratch-brush, and polish with a little oil."

Hand-Power Sawing Machine.—M. (*Bishop Auckland*) writes, in reply to S. P. (*Penarth*) (see page 782, Vol. II.):—"You can get a hand-power saw bench, with iron frame and table, 6 ft. by 2 ft., from Messrs. J. Carter & Co., New Bailey Street, Manchester, for £10 10s., to cut up to 3 in. thick; they also supply saw spindles, etc. If you write to them, they will most likely supply you with what you require."

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—W. H. Y. (*Battersea, S.W.*); G. G. (*Portsmouth*); C. S. (*London, N.W.*); DERNAX; LEGHORN; ANXIOUS (*Shepherd's Bush*); F. W. M. (*Clerkenwell*); E. S. (*Liverpool*); H. A. K. (*Bedale*); MOTOR; W. B. (*Longton*); C. B. (*London, E.C.*); B. A. W (*Croydon*); CLARIONETTE PLAYER; G. J. F. (*Chiswick*); J. B.; BIRD FANCIER; J. D. (*Poplar, E.*); BOWTON LAD; E. G. (*London, N.*); F. F. (*Leeds*); A. R. (*Blairgowrie*); A. J. T. LE G. (*Guernsey*); A. E. (*Leeds*); N. M. (*Sheffield*); ENGINEER; J. J. W. (*Hartlepool*); J. W. M. (*Ashton-under-Lyne*); F. P. (*Leeds*); J. C. (*Halifax*); A READER; J. B. (*Durham*); T. H. (*Stafford*); G. A. (*Edinburgh*); H. R. P.; H. S. P. (*Nottingham*); READER; S. S. (*Salford*); I. H. T. (*London, S.E.*); W. B. (*U.S.A.*); F. W. M. (*Preston*); N. N. (*Lancaster*); J. W. M. (*Duffield*); J. S. O. (*Weston-Super-Mare*); ARSENAL; PRETORIA; W. I. (*Lawrencekirk*); J. N. (*Cork*); T. R. B. (*Wandsworth*); SINE CERA.

Trade Note.

THE Second Annual Holborn Industrial Exhibition, 1891, will be held in the Holborn Town Hall and adjoining buildings, on April 29th, 30th, and May 1st, 1891.

"WORK" INDEX.

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A Novel Mechanical Puzzle.—Made on scientific principles. Artistic, Instructive. 6d.—132, Etruria Vale, Hanley, Staffordshire.

Water Motors, from 5s.: cheapest power known. List free.—WALTON, 9, Queen Anne St., Stoke-on-Trent.

Steam Engine, about one horse-power, good condition; exchange or sell. £3 10s.; worth £10. Particulars.—MANNELL, "Trefoy," Snodland, Kent.